THE

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OF

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FOR THE

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VOLUME XI.

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FUE'GO, TIERRA DEL, is the name by which the Archipelago is designated which constitutes the southern extremity of America. It is not known for what reason the Spaniards, who discovered it, gave it the name of Fire-land, but it is supposed that they observed some volcanic eruption on it, though modern navigators have never observed any thing of the kind, except Capt. B. Hall, whose description leaves no doubt that he really saw one.

If we exclude the islands lying along the western coast of South America, north of the Strait of Magalhaens, and consider those only as belonging to this Archipelago which are on the south of it as far as Cape Horn, Tierra del Fuego lies between 52° 30′ and 56° S. lat., and between 65° and 76° W. long. Staten Land however extends more than a degree farther east, but is divided from the Archipelago by the Strait le Maire, which is nearly 20 miles across. The whole length of the Archipelago, from Cape Good Success, on Strait le Maire, to Cape Pillar, at the western entrance of the Strait of Magalhaens, exceeds 400 miles. Its greatest breadth, between 65° and 70° W. long., is not less than 250 miles. In surface perhaps it may be equal to Great Britain, or at least not much less.

Tierra del Fuego consists of one large island, four others of moderate extent, and a great number of smaller islands and rocks. The larger island forms the eastern and northeastern portion of the group, and occupies considerably more than one half of the whole. It is called King Charles's Southland. On the south of it lie the islands of Navarin and Hoste, which are separated from it by Beagle Channel, extending in a straight line, east and west, for 120 miles, and being only from one-third of a mile to one mile across. Navarin island is separated from Hoste island by Ponsonby Sound. To the west of King Charles's Southland are two other large islands, Clarence island and South Desolation. The former is separated from King Charles's Southland by a crooked channel, which towards the Strait of Magalhaens is called Magdalen Sound, but towards the open sea Cockburn Sound. South Desolation, which forms the most western portion of the Archipelago, is separated from Clarence island by Barbara Channel.

The northern portion of King Charles's Southland is a plain, on which there are a great number of low hills, with a gentle ascent. No trees grow upon it, but there are shrubs and grasses. The shrubs are thinly scattered, but the grasses are abundant, and though of a harsh and dry appearance, they feed large flocks of guanacoes. Capt. Fitzroy considers this plain more fertile than those of Patagonia south of 45° S. lat., and thinks that parts of it may be cultivated. It is at present occupied by natives, resembling the Patagonians. [PATAGONIA.] The line of separation between this plain and the mountain-country begins on the Strait of Magalhaens, on the northern shores of Admiralty Sound, and extends thence to Cape Good Success. It is formed by mountains, which perhaps constitute an uninterrupted range, and some of which rise to an elevation of 4000 feet.

The mountainous portion of the Archipelago comprehends the southern and western part of King Charles's Southland, and all the other islands besides. It presents a succession of hills and mountains, valleys and ravines; the mountains rise in general to 2000 or 3000 feet, and several attain the snow-line, being more than 3500 feet in elevation. Mount Sarmiento, on Magdalen Sound, is 6000 feet high. The shores are intersected by deep but narrow arms of the sea, on whose sides rise the mountains, whose summits for the greatest part of the year are covered with snow, while their steep and rocky declivities are partially overgrown with evergreens. The natives of this country differ considerably from the Patagonians: they are low in stature, varying from 4 ft. 10 in. to 5 ft. 6 in. in height, and live in a very barbarous condition; they have frequently no other covering than a scrap of hide, which is tied to their waists. Their colour is darker than that of copper, and like mahogany or rusty iron.

The climate of this Archipelago is considered as extremely cold, and doubtless it is much colder than that of North Britain, which is situated at the same distance from the pole. The difference is perhaps best indicated by the different elevations at which the snow-line occurs. In North Britain it is supposed to be at an elevation of 5000 feet; but in Tierra del Fuego it occurs between 3000 and 3500 feet. The climate of Bergen, in Norway, is perhaps very similar to that of Tierra del Fuego, where, as at Bergen, cloudy weather, rain, and wind prevail throughout the year, and fine days are rare. No season is quite free from frost; the thermometer, even in February, which corresponds to our August, descends occasionally some degrees below the freezing point; but even during the winter, the mean temperature is, according to the observation of Capt. King, 2¼ degrees above that point, though it occasionally descends to 12¼° of Fahrenheit. It seems that this peculiarity of the climate is chiefly to be attributed to the high temperature of the sea, which on its surface is never lower than 45° of Fahrenheit, more especially in the Strait of Magalhaens, where the observations were made at Port Famine. The coasts, which are exposed to the influence of the open ocean, have probably a much colder climate, as during the winter they are surrounded by large fields of ice, which at that season occur as far north as 54° S. lat., along the shores of King Charles's Southland. The level portion of that island suffers rather from want than from abundance of moisture, like the eastern coast of Patagonia. The natural productions of this antarctic region are nearly unknown. Captain King found parrots and humming-birds on the shores of the Strait of Magalhaens. The natives of the mountainous portion live on fish, which seem to abound in the inlets. The extensive forests do not appear to contain trees fit for timber. Guanacoes feed on the extensive and

dry plains of King Charles's Southland, as already observed. (Captain Philip Parker King, in *London Geogr. Journal*, vol. i.; Captain Fitzroy, in ditto, vol. vi.; and Captain Basil Hall's *Journal.*)

FUEL is any combustible matter employed for the purpose of creating and maintaining heat. In the early ages of the world, wood must have constituted, as indeed in many countries it does to this day, the principal fuel employed. Wood consists chiefly of three principles: carbon, hydrogen, and oxygen. The two former are both of them highly combustible; and the last principle is especially so, and is the principal cause of the flame with which wood is well known to burn. When the smoke occasioned by the combustion of wood is found inconvenient, or when the fuel is required to last for a longer period in a given bulk, then charcoal is employed, which is merely wood that has undergone imperfect combustion, so as to expel its hydrogen and oxygen, and to leave the greater part of the carbon.

Another kind of fuel, which doubtless was early in use on account of the facility with which it is obtained from its nearness to the surface, is *peat*, or, as it is sometimes called, *turf:* this is a congeries of vegetable matter, in which the remains of organization are more or less visible. Peat is the common fuel of a large part of Wales and Scotland, and of many districts of England, where coal is not readily procured.

In this country, however, coal furnishes the great supply of fuel, and its various kinds are employed in different ways and for different purposes according to its nature and that of the substance to be acted on by its agency. When coal, by a process analogous to that by which charcoal is procured from wood, is freed from its more volatile constituents, hydrogen, oxygen, and azote, it is converted into coke; it then burns with but little flame and comparatively little smoke, and is used for giving an intense degree of heat in the reduction of most metallic ores, especially those of iron.

In some cases a mixture of coke and charcoal is very advantageously employed, especially in assaying in the small way. The mixture gives out a great degree of heat while burning, and being more combustible than coke alone, small furnaces, in which the draught is less powerful than in larger ones, are particularly adapted for its use: and though it consumes faster than coke, it lasts longer, gives a greater heat, and is more economical than charcoal alone.

In some countries, even the dried excrement of animals is used as fuel: and from the use of camel's dung the formation of sal ammoniac was derived in Egypt; this salt subliming from the excrement during its combustion.

In small chemical operations, as for the blow-pipe, tallow or wax candles are frequently employed; and in lamps, oil, spirit of wine, or pyroxilic spirit, and even carburetted hydrogen gas, are used, either for the purpose of boiling or evaporating small quantities of fluids, or dissolving various bodies in different menstrua.

During the combustion of different kinds of fuel, the products vary: thus, when wood, coal, wax, tallow, oil, alcohol, or carburetted hydrogen is employed, the principal products are carbonic acid gas and water; when charcoal is used, carbonic acid is almost the only volatile substance formed, for the hydrogen which the wood contained is expelled by the process of charring.

FUENTE RABIA, or **FONTARABIA**. [GUIPUZCOA.]

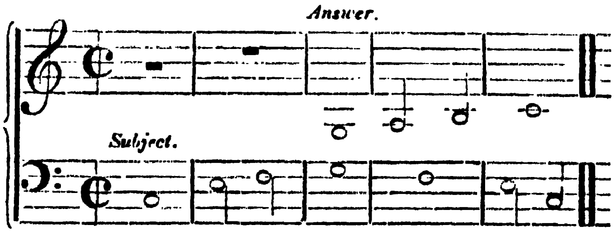
FUERTAVENTURA. [CANARIES.]

FUGGER, a German family, originally of Augsburg, that amassed great wealth in the fifteenth and sixteenth centuries by commerce, and especially by the monopoly of the spices, which they drew from Venice, and with which they supplied Germany and other parts of the Continent. The Fuggers were created counts by Charles V. in 1530, to whom they had lent large sums of money; and a story is told of their lighting a fire of cinnamon-wood with his bond or bonds for the amount, in the presence of Charles, who happened to be a visiter at their house in passing through Augsburg. They also supplied Philip II. with money, and two of their family contracted with the Spanish government for the mines of Almaden. [ALMADEN.] The family became divided into several branches, one of which obtained the rank of princes of the German empire, under the title of Fugger Babenhausen, near Ulm. The family continue to this day, and their domains are partly in Bavaria and partly in Würtemberg. The Fugger family, in the sixteenth century, made a liberal use of their wealth, in founding charitable institutions, such as the one still called Fuggerei [AUGSBURG]; in promoting learning, collecting MSS., and forming valuable libraries. Several members of the family were themselves men of learning; among others Ulrich Fugger, born about 1520, was for a time a confidential attendant of Pope Paul III., but afterwards returned to Germany, and had several valuable MSS. of classic authors which he had collected printed at his own expense. He engaged as his printer Henri Estienne, with a handsome salary. His family being dissatisfied with his expenditure, obtained an order from the civil courts taking away from Ulrich the administration of his property under the pretence of incapacity; but the order was ultimately rescinded, and he was restored to his rights. He died in 1584 at Heidelberg, leaving his fine library to the Elector Palatine and several legacies to poor students. Another Fugger wrote a history of Austria, published at Nürnberg in 1668. Philip Edward Fugger, born in 1546, added greatly to the library and cabinet of antiquities begun by his ancestors at Augsburg, and distinguished himself by his munificence. Otho Henry Fugger, count of Kirchberg and Weissenhorn, born in 1592, served with the Spanish army in Italy, and afterwards raised troops in Germany for the Emperor Ferdinand II. during the Thirty Years' War. (Imhoff, *Notitia Imperii;* Moreri's *Dictionary*, art. 'Fugger;' *Almanach de Gotha.*)

FUGUE, in music, a composition in which a Subject, or brief air, passes successively and alternately from one part to another, according to certain rules of harmony and modulation. Such is Rousseau's definition, which would have been more complete if he had added that the Fugue is also formed after rules peculiar to itself. The term seems to have originated about the middle of the fifteenth century, and is commonly supposed to be derived from the Latin word *fuga* (flight), because the theme, or point, flies from part to part; but this etymology is by no means satisfactory, though we certainly have no better to offer

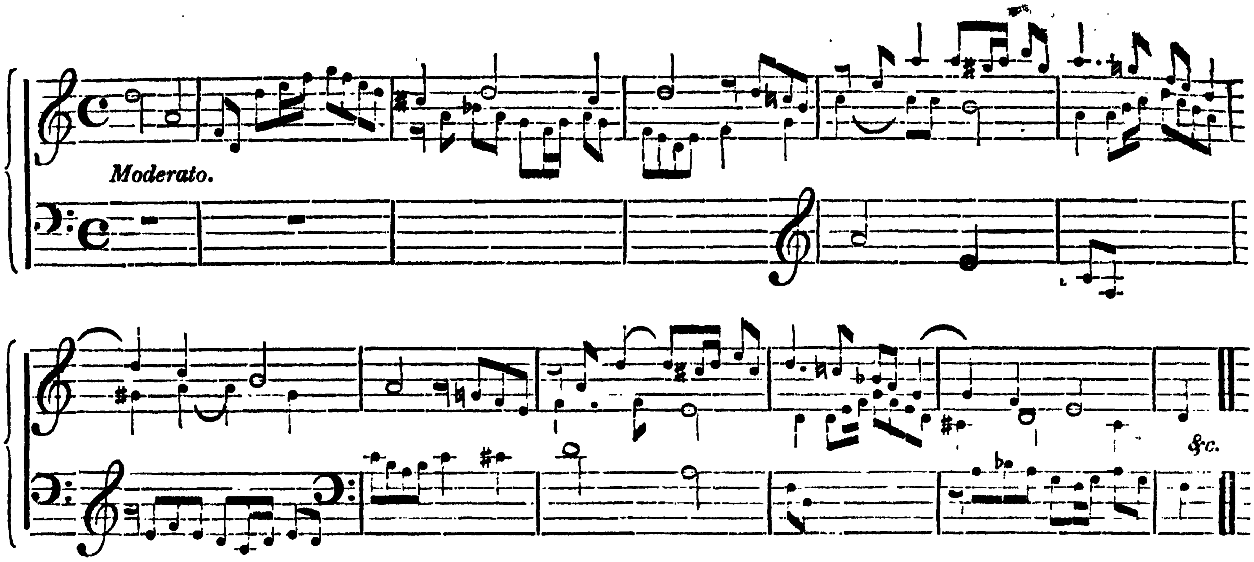
Writers on music enumerate many kinds of Fugue, the chief of which are, the Strict Fugue, the Free Fugue, the Double Fugue, and the Inverted Fugue; to which we shall add that species—for it decidedly belongs to the Fugue genus called Imitation.

'In a Strict Fugue,' says Dr. Crotch (*Elements of Composition*), 'the subject is given out by one of the parts, then the answer is made by another; and afterwards the subject is repeated by a third part, and, if the fugue consist of four parts, the answer is again made by the fourth part: after which the composer may use either the subject or the answer, or small portions of them, in any key he pleases, or even on different notes of the key.' In this severe kind of composition, when the subject, or leader, or point, or *dux*, or by whatever name the theme may be designated, is comprised between the tonic and the dominant, the answer (or *Comes*) must be given in the notes contained between the dominant and the octave. Ex.:



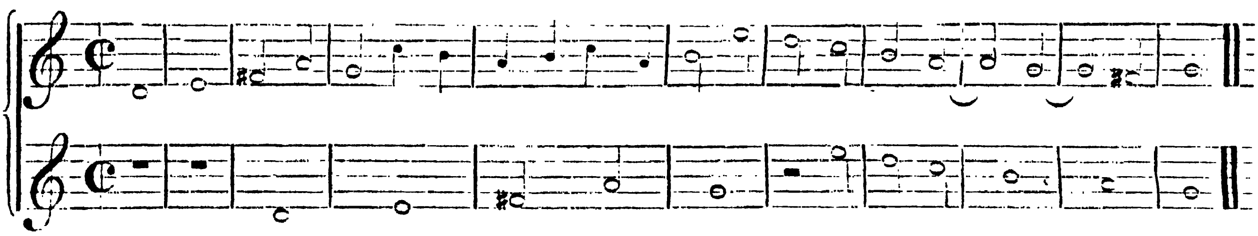
The chorus 'He trusted in God,' in the *Messiah*, is a fine specimen of this sort of fugue, to which we refer the reader; for few are without that sublime oratorio in some form.

In the Free Fugue much more latitude is allowed the composer; he is not so restrained by the subject, but may introduce what Albrechtsberger terms episodes—passages not closely related to the theme, though they should never be very foreign to it. The overture to the *Zauberflöte* affords a splendid example of this species. The Double Fugue consists of two or more subjects, moving together, and dispersed among the different parts. Dom. Scarlatti's in D minor is a double fugue which has no superior of its kind. The first few bars of this will more clearly explain than words can do the nature of so elaborate a species of composition.



Fugues of more than two subjects are classed, not very correctly, among double fugues; they are however rare, for which reason perhaps they have never received a distinguishing name. Of these the fugue of four subjects in the finale to Mozart's grand symphony in C, and that of the same description in Handel's *Alexander's Feast*, the chorus 'Let Old Timotheus yield the prize,' are master-pieces of their kind. All of this species must be considered as free fugues. The term Fugue by Inversion requires little explanation. In this the theme is inverted, as the name implies, but the effect arising out of such contrivance is appreciable only by those who know its difficulty, and estimate its merit by the quantity of labour it has cost. In the Fugue by Augmentation, the notes of the answer are doubled in length. In the Fugue by Diminution, exactly the reverse takes place. There are also other kinds of Fugue, but they are now almost forgotten, and it would be waste of paper and print to revive their names.

Imitation is a species of fugue, and by theorists is generally treated on previously to and as the precursor of the latter. As the word indicates in this kind of composition, the theme is more or less imitated in the different parts. It is not, says Fux (*Gradus ad Parnassum*), required that every note should be imitated, but only some part of the subject: and Imitation is rather to take place in the middle than in the commencement of a composition. It may be made in any of the intervals, and in fact is governed by scarcely any rule. The learned contrapuntist just named gives the following as an example of Imitation in the Unison:—



The effect of technical imitation in music is unquestionably great: it is felt by all who have the slightest skill in the art, therefore employed by all great composers of every school, antient and modern. Canon, which is sometimes called a perpetual fugue, may perhaps be admitted, though cautiously, as part of a course of professional study, but should rarely, if ever, be allowed to pass the boundaries of the school. [CANON.] Fugue, but not of the pedantic or fantastic kind, should be an object of serious attention with those who are ambitious of becoming great composers, though in its severe form it ought to be almost confined to cathedral music and to the oratorio, and is admissible there only when introduced with great discretion, and guided by the hand of an experienced sensible master. But without that which is here to be understood by the term imitation—or the recurrence, in some shape, of the chief subject—music in parts, of even a very simple kind, loses one of its greatest beauties. Let it be used however with a view solely to effect: if resorted to for the mistaken purpose of displaying what a young or a dull composer may call his learning, imitation will prove to be nothing better than mere plodding, and capable of exciting no emotion except that which is the very reverse of pleasing.

FULCRUM. [LEVER.]

FULDA, river. [WESER.]

FULDA, a province of the electorate of Hesse-Cassel, between 50° and 51° N. lat., and 9° and 10° E. long., is bounded on the north-east by Saxe-Weimar, on the east and south-east by Bavaria, and on the west by the grand-duchy of Hesse-Darmstadt. Its area is about 880 square miles, and its population about 126,600. It contains part of the former grand duchy of Fulda (a considerable portion of it having been united to Bavaria in 1815), the principality of Hersfeld, and the seigniory of Schmalkalden. The former territory of Fulda was one of the oldest ecclesiastical endowments in Germany, having been founded by Bonifacius and his colleague Sturm, in the year 744: it ceased however to be under episcopal jurisdiction in 751, was revived as a bishoprick in 1752, fell to the prince of Nassau-Orange as a secularized principality in 1803, was incorporated by Napoleon with the grand-duchy of Frankfort in 1810, and in 1815, after being ceded to Prussia, was immediately afterwards made over to Hesse-Cassel. The soil is not so rich as that of other parts of the electorate; the country is intersected by branches of the Rhön and Vogel ranges, and watered by the Fulda, Kinzig, Werra, Haune, and other rivers. It produces corn, flax, potatoes, and timber, in considerable quantities. The rearing of cattle is one of the principal occupations of the inhabitants: among the mineral productions are brown coal, potter's clay, and small quantities of salt.

The province is divided into the circles of Hersfeld, Schmalkalden, Hünfeld, and Fulda, and contains five towns, seven market villages, and 198 other villages, together with about 17,200 houses. Besides Fulda, the chief town, the principal towns are Hersfeld, on the Fulda, and Geiss, a walled town, with a spacious market place, a castle, 2 churches, about 670 houses and 6400 inhabitants, and manufactures of woollens, dimity, serges, and leather. Schmalkalden, on the Schmalkalde, surrounded by walls, with 3 suburbs, the 2 castles of Wilhelmsburg and Hessenhof, 2 churches, 2 gymnasia, and salt-works producing annually about 620 tons. The population is about 4850. Large quantities of iron and steel ware are made here, besides salt, stockings, white lead, arms, buttons, pipeheads of Meerschaum, woollen yarn, &c. This was the place where the Protestant princes of Germany formed a league for their mutual defence in 1531, after six great assemblies held here

between 1529 and 1540. The Schmalkald articles were also promulgated from this spot in 1537. Steinbach, a market village on the Hasel, with about 390 houses, and 2500 inhabitants, who manufacture iron-ware. Hünfeld on the Haune, a town with walls, 2 churches, about 280 houses, and 1800 inhabitants, with manufactures of linens, and some trade in yarns: and Brotterode, an irregularly built town, 1708 feet above the level of the sea, with about 350 houses, and 2100 inhabitants, and manufactures of tin, tobacco, brass and steel ware, &c.

FULDA, the capital of the province, and the seat of its government and law courts, is about 60 miles north-east of Frankfort on the Main, at an elevation of 834 feet above the level of the sea; in 50° 34′ N. lat., and 9° 44′ E. long. It is built on the banks of the Fulda, which is crossed by a handsome stone bridge. Fulda is a pretty town, with eight suburbs outside its walls. The walls, which are decayed, have seven gates. Its population, which was 7468 in 1810, and 8150 in 1817, is at present about 9600; the houses are about 1100. It contains a market-place and two squares, one of which is a public promenade, with rows of linden trees, an electoral palace and grounds, eleven churches, one of which is Lutheran, a Roman Catholic Lyceum, which was instituted out of the funds of the university, founded in 1734, a Protestant high-school, a chapter seminary, a school in which forest economy is taught, and another for educating teachers, an hospital, public library, &c. It is the residence of the Roman Catholic bishop for the electorate, and has a handsome cathedral or minster, built between the years 1700 and 1712: it is memorable as the place of sepulture of St. Bonifacius, whose remains were deposited below an altar in an underground chapel in 755, the year of his death. The manufactures of Fulda are on a confined scale, and consist of linens, woollens, stockings, saltpetre, leather, articles in wood, &c. The mineral spring, on St. John's Hill near the town, resembles the Seltzer water. About five miles out of Fulda is the electoral country-seat called the Fasanerie, where there are valuable collections of paintings, china, and subjects in natural history. St. Bonifacius's Well, in the midst of some well laid out shrubberies, is also close to the town.

FULGE'NTIUS, FABIUS CLAUDIUS GORDIANUS, bishop of Ruspina, a town on the coast of Africa, was born about A.D. 464. His father Gordianus, who was a senator of Carthage, was obliged to leave his native city during the persecutions of the Vandals, and retired to Telepte, in the province of Byzacium, where Fulgentius passed the early years of his life. He is said to have made great progress in his studies, and to have acquired an accurate knowledge of the Greek and Latin languages. In consequence of his attainments, he was appointed at an early age to receive the public revenues of the province; but he resigned his office soon after his appointment, and retired to a monastery in the neighbourhood. After enduring many persecutions on account of his opposition to the Arian doctrines, he resolved to go into Egypt to visit the celebrated monks of that country. From this design he was dissuaded by Eualius, bishop of Syracuse, on the ground that the monks of the East had withdrawn from the Catholic communion, and accordingly he proceeded to Rome, A.D. 500. On his return to his native country, the Catholic clergy elected him bishop of Ruspina; but he did not enjoy his dignity long, being exiled to Sardinia, together with the other Catholic bishops of that part of Africa, by Thrasimond, king of the Vandals. His learning, his austere manner of living, and his frequent controversies with the Arians, procured him the universal respect of the Catholic clergy, who considered him the greatest ornament of the African church in that age. Curiosity led Thrasimond to recal him to Carthage, where he held disputes with the king on the debated points of the Arian controversy; but as he was unable to convince the monarch, he was obliged to return to Sardinia, where he remained till A.D. 522, when the death of Thrasimond and the succession of Hildericus to the throne occasioned the recal of the Catholic bishops. Fulgentius returned to Ruspina, and resided there till the time of his death, which happened either in A.D. 529 or 536.

His works were printed at Paris, in a 4to. volume, in 1684. With regard to his style, Dupin remarks, 'that St. Fulgentius did not only follow the doctrine of St. Austin, but also imitated his style. He had a quick and subtle spirit, which easily comprehended things, set them in a good light, and explained them copiously, which may appear unpleasant to those who read his works. He loved thorny and scholastic questions, and used them sometimes in mysteries. He knew well the holy Scriptures, and had read much the works of the fathers, particularly those of St. Austin.' His principal works are:—I. 'Three Books to Thrasimond, king of the Vandals, on the Arian Controversy;' II. 'Three Books to Monimus.' The first supports the opinions of Augustine on the doctrine of predestination; the second explains the sacrifice of Christ and the passage in 1 Cor. vi., 6, 'But I speak this by permission, and not of commandment;' the third contains remarks on the Arian interpretation of John i., 1, 'The word was with God.' III. 'Two Books to Euthymius, on the Remission of Sins,' to show that God will pardon sins only in this life; IV. 'A Book to Donatus, on the Trinity;' V. 'Three Books on Predestination, to John, a priest, and Venerius, a deacon;' VI. 'A Book on Faith;' VII. 'Letters on various religious Subjects,' written principally during his exile.

(Dupin's *Bibliothèque Ecclésiastique*, vol. v., p. 13-21; Eng. Trans.; *Acta Sanctorum*, vol. i., Januar., p. 32.)

FULGENTIUS FERRANDUS, who is frequently confounded with Fulgentius, bishop of Ruspina, lived in the beginning of the sixth century. He was a disciple of the bishop of Ruspina, whose life he wrote. He was also the author of an 'Abridgment of the Canons,' and finished a treatise addressed to Reginus, on which his master was engaged at the time of his death.

(Mosheim's *Ecclesiastical History*, vol. ii., p. 109: Eng. Trans., 1826.)

FULGENTIUS, FABIUS PLANCIADES, is said to have been a bishop of Carthage, and to have lived in the sixth century. He wrote a work on Mythology, in three books, addressed to a priest of the name of Catus, which was printed for the first time at Milan, in 1487. There is another work of Fulgentius, entitled 'Expositio Sermonum Antiquorum ad Chalcidicum Grammaticum,' which is usually printed with the works of Nonius Marcellus

(Fabricii, *Bibliotheca Latina*, lib. ii., c. 2.)

FULGURITES are vitrified sand tubes, supposed to have originated from the action of lightning; they are called by the Germans *blitzröhre*.

These tubes were discovered in the year 1711 by the pastor Herman, at Massel in Silesia; and they were again discovered in 1805 by Dr. Hentzen, in the heath of Paderborn, commonly called the Senne, and he first attributed their formation to the agency of lightning.

These tubes have since been found in great number at Pillau, near Königsberg, in Eastern Prussia; at Nietleben, near Halle on the Saale; at Drigg in Cumberland, and some other places.

At Drigg, the tubes were found in the middle of sandbanks forty feet high, and very near the sea. In the Senne they were most commonly found on the declivities of mounds of sand, about thirty feet high; but sometimes in cavities, which are stated to have been hollowed in the heath, in the form of bowls, 200 feet in circumference, and 12 to 15 feet in depth.

These tubes are nearly all hollow. At Drigg their external diameter was 2½ inches; those of the Senne, reckoning from the surface, are from one quarter to seven lines internal diameter; but they narrow as they descend lower, and frequently terminate in a point: the thickness of the tube varies from half a line to one inch.

These tubes are usually placed vertically in the sand; but they have been found at an angle of 40°. Their entire length, judging from those which have been extracted, is from twenty to thirty feet; but frequent tranverse fissures divide them into portions from half an inch to five inches in length.

Usually there is only one tube found at a place; sometimes however, at a certain depth, this tube divides into two or three branches, each of which gives rise to small lateral branches, from an inch to a foot in length; these are conical, and terminate in points, inclining gradually to the bottom.

The internal part of the tubes is a perfect glass, smooth and very brilliant, resembling hyalite. It scratches glass, and gives fire with steel. All the tubes, whatever may be their form, are surrounded by a crust composed of agglutinated grains of quartz, which have the appearance, when examined by a glass, of having undergone incipient fusion.

The colour of the internal mass of the tubes, and especially that of the external parts, depends upon the na-

ture of the sandy strata which they traverse. In the superior beds, which contain a little soil, the exterior of the tubes is frequently black; lower down the colour of the tube is of a yellowish grey; still lower, of a greyish white; and lastly, where the sand is pure and white, the tubes are almost perfectly colourless.

That the cause of these tubes is correctly attributed to lightning is shown by some observations presented to the Royal Society, in 1790, by Dr. Withering. On opening the ground where a man had been killed by lightning, the soil appeared to be blackened to the depth of about ten inches; at this depth, a root of a tree presented itself, which was quite black; but this blackness was only superficial, and did not extend far along it. About two inches deeper, the melted quartzose matter began to appear, and continued in a sloping direction to the depth of eighteen inches; within the hollow part of one mass, the fusion was so perfect, that the melted quartz ran down the hollow, and assumed nearly a globular figure.

Professor Hagen, of Königsberg, has made a similar observation. In the year 1823 the lightning struck a birch tree at the village of Rauschen; on cautiously removing the earth, Professor Hagen found, at the depth of a foot, the commencement of a vitrified tube, but it could not be extracted from the sand in pieces of more than two or three inches in length; the interior of these fragments was vitrified, as usual; several were flattened, and had zigzag projections.

It is also to be observed, that Saussure found on the slaty hornblende of Mont Blanc small blackish beads, evidently vitreous, and of the size of a hemp-seed, which were clearly the effects of lightning. Mr. Ramond has also remarked on the Pic du Midi, in the Pyrenees, some rocks, the entire face of which is varnished with a coating of enamel, and covered with beads of the size of a pea; the interior of the rock is totally unchanged.

FULHAM. [MIDDLESEX.]

FULICA. [RALLIDÆ.]

FULIGULINÆ, a subfamily of the *Anatidæ*. The prince of Musignano (C. L. Bonaparte) arranged, under the subgenus *Fuligula*, those species of ducks which other modern ornithologists have distinguished by the generic titles of *Somateria*, *Oidemia*, *Fuligula*, *Clangula*, and *Harelda*. The prince observes, that M. Temminck, who had been opposed to all dismemberment of the great genus *Anas*, had at last been induced to assemble all the species of the prince's subgenus *Fuligula* under one genus; whence the prince argues the necessity of M. Temminck's admitting the *swans* and *geese* as distinct genera; and he observes that he cannot see any good reason why M. Temminck should have rejected the name of *Fuligula*, as well as *Platypus*, given anteriorly to the genus by Brehm, and should have imposed on it the name of *Hydrobates*, a term already applied by Vieillot to the genus *Cinclus*. (*Specchio Comparativo*.)

Mr. Swainson (*Fauna Boreali-Americana*) adopts the term *Fuligulinæ* to distinguish this subfamily, under which he arranges the genera *Somateria*, *Oidemia*, *Fuligula*, *Clangula*, and *Harelda*.

Habits, Food, &c.—The *Fuligulinæ*, or *sea ducks*, as they have been not inaptly named, frequent the sea principally; but many of them are to be found in the fresh-water lakes and rivers where the water is deep. The plumage is very close and thick in comparison with that of the true ducks (*Anatinæ*), and the covering of the female differs much in hue from that of the male, which when adult undergoes but little change in its dress from the difference of season. The young resemble the female in their feathered garb, and do not assume the adult plumage till the second or third year. Moulting takes place twice a year without change of colour. In the male, the capsule of the trachea is large.

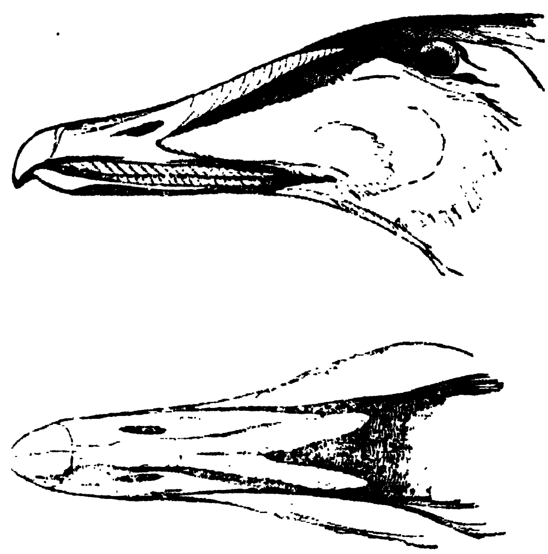
The *Sea Ducks* are not good walkers, on account of the backward position of their feet, but they run, or rather shuffle along rapidly, though awkwardly. They swim remarkably well, though low in the water, and excel in diving, whether for amusement, safety, or food, which last consists of insects, mollusks, the fry of fish, and marine or other aquatic vegetables. They take wing unwillingly as a security from danger, relying more confidently on their powers of diving and swimming as the means of escape, than on those of flight. Though they are often strong, steady, rapid, and enduring in their passage through the air, they generally fly low, laboriously, and with a whistling sound.

This subfamily may be considered to be monogamous, and the nest is frequently made near the fresh waters; the female alone incubating, though both parents, in several of the species at least, strip the down from their breasts as a covering for the eggs, which are numerous.

Geographical Distribution.—The North may be considered the great hive of the *Fuligulinæ*; though some of the forms are spread over the greater part of the globe. Large flocks are seen to migrate periodically, keeping for the most part the line of the sea-coast, and flying and feeding generally by night, though often, especially in hazy or blowing weather, by day.

SOMATERIA. (Leach.)

Generic Character.—*Bill* small, with the base elevated and extending up the forehead, where a central pointed line of feathers divides it; the anterior extremity narrow but blunt; *nostrils*, mesial; *neck*, thick; *wings*, short; *tertiaries* long, and generally with an outward curve, so as to overlie the *primaries*. Tail moderate, consisting of 14 feathers.



Bill of Eider Duck.

This genus is peculiarly marine. Dr. Richardson, whose opportunities of observing the northern birds were so great, and so well used, says, that *Somateriæ spectabilis* and *mollissima* are never, as he believes, seen in fresh water; their food consisting mostly of the soft mollusca in the Arctic Sea. They are, he says, only partially migratory, the olde birds seldom moving farther southwards in winter than to permanent open water. He states that some *eider ducks* pass that season on the coast of New Jersey, but that the *king ducks* (*S. spectabilis*) have not been seen to the southward of the 59th parallel. Audubon however says, that in the depth of winter the latter have been observed off the coast of Halifax, in Nova Scotia, and Newfoundland, and that a few have been obtained off Boston, and at Eastport in Maine.

The genus is remarkable for the high development of the exquisitely soft and elastic down so valuable in commerce, and so essential to the keeping up of the proper balance of animal heat in the icy regions inhabited by these birds. We select as our example:—

Somateria mollissima (*Anas mollissima*, Linn.), the *Eider Duck*. This is the *Oie à duvet ou Eider* of the French; *Die Eidergans* and *Eiterente* of the Germans; *Oca Settentrionale* of the Italians (*Stor. degli ucc.*); the *Eider Goose*, *Eider Duck*, *St. Cuthbert's Duck*, *Cuthbert-Duck*, or *Cutbert-Duck*, *Great black and white-Duck*, and *Colk Winter Duck*, of the modern British; *Hwyad fwythblu*, of the ancient British; *Dunter Duck*, of the Hudson's Bay residents; and *Mittek*, of the Esquimaux.

The following is Dr. Richardson's description of a *male* killed June, 14, 1822, at Winter Island, 66° 11½′ N. lat. *Colour*. Circumference of the frontal plates, forehead, crown, and under eye-lid, deep Scotch blue; hind head, nape and temples, siskin-green. Stripe on the top of the head, cheeks, chin, neck, breast, back, scapulars, lesser coverts, curved tertiaries, sides of the rump, and under wing-coverts, white; the tertiaries tinged with greenish yellow, and the breast with buff. Greater coverts, quills, rump, tail and its co-

verts, and the *under plumage*, pitch black; the end of the quills and tail fading to brown. *Bill*, oil-green. *Legs*, greenish yellow.

Form. *Bill* prolonged on the lengthened, depressed forehead, into two narrow flat plates that are separated by an angular projection of the frontal plumage. *Nostrils* not pervious. *Neck*, short and thick. *Wings* nearly three inches shorter than the tail. Hind toe attenuated posteriorly into a broad lobe. The length of this bird was 25 inches 6 lines.

Female. Pale rufous or yellowish brown with black bars; *wing-coverts* black, with ferruginous edges; *greater coverts* and *secondaries* with narrow white tips; head and upper part of the neck striped with dusky lines. *Beneath*, brown with obscure darker blotches.

Young at the age of a week. Of a dark mouse colour, thickly covered with soft warm down.

Young male. Like the female; and not appearing in the full adult male plumage till the fourth year.

Geographical Distribution.—The icy seas of the North appear to be the principal localities of this species. Captain, now Major Edward Sabine, enumerates it among the animals which were met with during the period in which the expedition under Captain Parry remained within the Arctic circle. He mentions it as abundant on the shores of Davis' Straits and Baffin's Bay: but adds, that deriving its food principally from the sea, it was not met with after the entrance of the ships into the Polar Ocean, where so little open water is found. The females were without the bands on the wings described by authors. (Appendix to Captain Sir W. E. Parry's First Voyage, 1819—20.) The late lamented Captain Lyon saw the Eider in Duke of York's Bay. (*Journal*.) Captain James Ross (Appendix to Captain Sir John Ross's Last Voyage), notices vast numbers of the *king duck* as resorting annually to the shores and islands of the Arctic regions in the breeding season, and as having on many occasions afforded a valuable and salutary supply of fresh provision to the crews of the vessels employed in those seas. Speaking of the *eider duck* he says, it is so similar in its habits to the *king duck*, that the same remarks apply equally to both. In Lapland, Norway, Iceland, Greenland, and at Spitzbergen, the eider duck is very abundant; and it abounds also at Bering's Island, the Kuriles, the Hebrides, and Orkneys. In Sweden and Denmark it is said to be more rare, and in Germany to be only observed as a passenger. Temminck states that the young only are seen on the coasts of the ocean, and that the old ones never show themselves. Captain James Ross, in the Appendix above alluded to, speaking of the eider down, says that the down of the *king duck* is equally excellent, and is collected in great quantities by the inhabitants of the Danish colonies in Greenland, forming a valuable source of revenue to Denmark. A vast quantity of this down, he adds, is also collected on the coast of Norway, and in some parts of Sweden. The eider duck is found throughout Arctic America, and is said to wander, in severe winters, as far south to sea as the capes of the Delaware. From November to the middle of February, small numbers of old birds are usually seen towards the extremities of Massachusetts Bay, and along the coast of Maine. A few pairs have been known to breed on some rocky islands beyond Portland, and M. Audubon found several nesting on the island of Grand Manan in the Bay of Fundy. The Prince of Musignano notes it as rare and adventitious in the winter at Philadelphia. The most southern breeding place in Europe is said to be the Fern or Farn Isles, on the coast of Northumberland.

Habits, Reproduction, &c.—Willughby, quoting Wormius, says that the Eider Ducks 'build themselves nests on the rocks, and lay good store of very savoury and well-tasted eggs; for the getting of which the neighbouring people let themselves down by ropes dangerously enough, and with the same labour gather the feathers (*Eider dun* our people call them), which are very soft and fit to stuff beds and quilts; for in a small quantity they dilate themselves much (being very springy) and warm the body above any others. These birds are wont at set times to moult their feathers, enriching the fowlers with this desirable merchandize.' Willughby also remarks that 'when its young ones are hatched it takes them to the sea and never looks at land till next breeding time, nor is seen anywhere about our coasts.' This early account is in the main correct; but there are two kinds of Eider down: the *live down*, as it is termed, and the *dead down*; the latter, which is considered to be very inferior in quality, is that taken from the dead bird. The down of superior quality, or live down, is that which the duck strips from herself to cherish her eggs. Its lightness and elasticity are such, it is asserted, that two or three pounds of it squeezed into a ball which may be held in the hand will swell out to such an extent as to fill a case large enough for the foot covering of a bed. It is collected in the following manner: The female is suffered to lay her five or six eggs, which are about three inches in length and two in breadth. These, which are very palatable, are taken, and she strips herself a second time to supply the subsequent eggs. If this second batch be abstracted, the female being unable to supply any more down, the male plucks his breast, and his contribution is known by its pale colour. The last deposit, which rarely consists of more than two or three eggs, is always left; for if deprived of this their last hope, the bereaved birds forsake the inhospitable place; whereas, if suffered to rear their young, the parents return the following year with their progeny. The quantity of down afforded by one female during the whole period of laying is stated at half a pound neat, the quantity weighing nearly a pound before it is cleansed. Of this down Troil states that the Iceland company sold in one year (1750) as much as brought 850*l*. sterling, besides what was sent to Glückstadt.

The haunts of birds capable of producing so valuable an article are not unlikely to be objects of peculiar care: we accordingly find that in Iceland and Norway the districts resorted to by them are reckoned valuable property, and are strictly preserved. Every one is anxious to induce the Eiders to take up their position on his own estate: and when they show a disposition to settle on any islet, the proprietor has been known to remove the cattle and dogs to the mainland in order to make way for a more valuable stock, which might be otherwise disturbed. In some cases, artificial islets have been made by separating promontories from the continent; and these Eider tenements are handed down from father to son like any other inheritance. Notwithstanding all this care to keep the birds undisturbed, they are not, as we shall presently see, scared by the vicinity of man, in some places at least. We proceed to give the personal observations of some of those who have visited Eider settlements:—'When I visited the Farn Isles,' writes Pennant (it was on the 15th July, 1769), 'I found the ducks sitting, and took some of the nests, the base of which was formed of sea-plants, and covered with the down. After separating it carefully from the plants, it weighed only three-quarters of an ounce, yet was so elastic as to fill a larger space than the crown of the greatest hat. These birds are not numerous on the isles; and it was observed that the drakes kept on those most remote from the sitting-places. The ducks continue on their nests till you come almost close to them, and when they rise are very slow fliers. The number of eggs in each nest was from three to five, warmly bedded in the down, of a pale olive colour, and very large, glossy and smooth.' Horrebow declares that one may walk among these birds while they are sitting without scaring them; and Sir George Mackenzie, during his travels in Iceland, had an opportunity, on the 8th June at Vidöe, of observing the Eider ducks, at all other times of the year perfectly wild, assembled for the great work of incubation. The boat, in its approach to the shore, passed multitudes of these birds, which hardly moved out of the way; and, between the landing-place and the governor's house, it required some caution to avoid treading on the nests, while the drakes were walking about, even more familiar than common ducks, and uttering a sound which was like the cooing of doves. The ducks were sitting on their nests all round the house, on the garden wall, on the roofs, nay even in the inside of the houses and in the chapel. Those which had not been long on the nest generally left it when they were approached; but those that had more than one or two eggs sat perfectly quiet and suffered the party to touch them, though they sometimes gently repelled the intrusive hand with their bills. But, if a drake happen to be near his mate when thus visited, he becomes extremely agitated. He passes to and fro between her and the suspicious object, raising his head and cooing.

M. Audubon saw them in great numbers on the coast of Labrador—where, by the way, the down is neglected*.

* Audubon says that the eggers of Labrador collect it; but, at the same time, make such havoc among the birds, that at no very distant period the traffic must cease.

employed about their nests, which they begin to form about the end of May. They arrive there and on the coasts of Newfoundland about the first of that month. The eggs were of a dull greenish-white, and smooth, from six to ten in number. The nest was usually placed under the shelter of a low prostrate branched and dwarf fir*; and sometimes there were several under the same bush, within a foot or two of each other. The ground-work of the nests consisted of sea-weeds and moss, and the female did not add the down till the eggs were laid. The duck, having at this time acquired an attachment for her eggs, was easily approached, and her flight was even and rather slow. Audubon states that, as soon as incubation has commenced, the males leave the land and join together in large flocks out at sea: they begin to moult in July, and soon become so bare as to be scarcely able to rise from the water. By the 1st of August, according to the same author, scarcely an Eider Duck was to be seen on the coast of Labrador. The young, as soon as hatched, are led by the female to the water, where they remain, except at night and in stormy weather. Their greatest feathered enemy is the Saddle-backed Gull, or Black-backed Gull (*Larus marinus*), which devours the eggs and young, but whose pursuit the young, after they have left the nest, elude by diving, at which both old and young are very expert.

Eider Duck, male and female.

According to Brunnich and others, the male utters a hoarse and moaning cry at the pairing time, but the cry of the female is like that of the common duck. Both sexes assist in forming the nest, though the female only sits: but the male watches in the vicinity, and gives notice of the danger. This seems to be confirmed by the account given of the nesting-place at Vidöe. Sometimes two females deposit their eggs in the same nest, and sit amicably together. The Gulls are not their only enemies in addition to man, for the Ravens often suck their eggs and kill their young. At sea, several hatches congregate, led by the females, and there they may be seen splashing the water in the shallows, to beat up the small crustaceans and mollusks, and diving in deeper water for the larger marine animals, among which muscles and other conchifers, turbinated testaceans, and occasionally sea-eggs (*Echini*) are said to be taken.

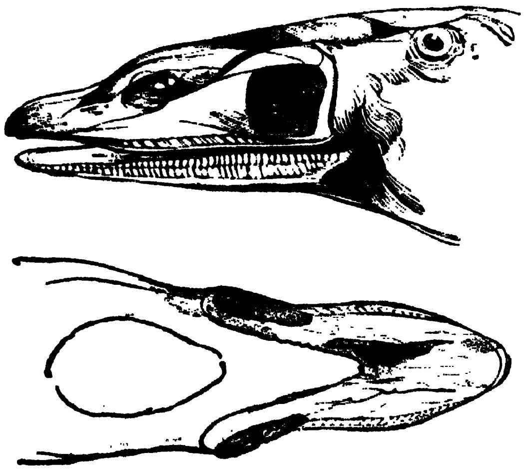
Utility to Man.—The down above described is the principal tribute paid by the Eider Duck to man: but the Indian and Greenlander eat the flesh, which is dark and fishy, and their skin is converted into a warm inner garment. According to Sir W. E. Parry, the Esquimaux Indians catch these birds with springes made of whalebone, and take the eggs wherever they can find them. The skin, prepared with the feathers on, forms an article of commerce, particularly with the Chinese. M. Audubon is of opinion that if this valuable bird were domesticated, it would prove a great acquisition, both on account of its down, and its flesh as an article of food; and he is persuaded that very little attention would effect this. Indeed, it appears that the experiment was made at Eastport with success, but the greater number of the ducks were shot, being taken by gunners for wild birds. The same author says that, when in captivity, it feeds on different kinds of grain and moistened corn-meal, when its flesh becomes excellent. Mr. Selby succeeded twice in rearing Eiders from the egg, and kept them alive upwards of a year, when they were accidentally killed.

Oidemia. (*Fleming.*)

Generic Character.—*Bill*, broad with dilated margins, and coarse lamelliform teeth, gibbous above the *Nostrils*, which are nearly mesial, large and elevated. *Tail*, of fourteen feathers.

The *Oidemiæ* seek their food at sea principally; and have obtained the name of *Surf Ducks*, from frequenting its edge. The prevailing colour of the tribe is black in the male, and brown in the female. The plumage is very thick and close; and, according to Audubon, the down in the *Velvet Duck* (*Oidemia fusca*) is similar to that of the *Eider Duck*, and apparently of equal quality. Their flesh is high-flavoured and oily, according to Dr. Richardson, who gives that character to the flesh of three species, viz. *Oidemiæ perspicillata*, *fusca*, and *nigra*. The two former, according to that enterprising zoologist, breed on the Arctic coasts, migrate southward in company with *Clangula* (*Harelda?*) *glacialis*, halting both on the shores of Hudson's Bay and on the lakes of the interior, as long as they remain open, and then feed on tender shelly mollusca. *Oidemia nigra*, he adds, frequents the shores of Hudson's Bay, and breeds between the 50th and 60th parallels. It was not seen by Dr. Richardson and his companions in the interior. We select, as an example—

Oidemia perspicillata, *Anas perspicillata* of Linnæus, the *Black* or *Surf Duck*. This is the *Macreuse à large bec ou Marchand* and *Canard Marchand* of the French, *the Black Duck* of Pennant, and *the Great Black Duck from Hudson's Bay* of Edwards.



Bill of Oidemia perspicillata.

Description.—*Male*, velvet black, with a reddish reflexion. Throat brownish. A broad white band between the eyes, and a triangular patch of the same on the nape. *Bill* reddish orange, the nail paler; a square black spot on the lateral protuberance. *Legs* orange; webs brown. Bill much like that of the *Velvet Duck* (*Oidemia fusca*), but

* Nuttall suggests that the fir was, probably, *Pinus Banksiana*.

lateral protuberances are naked and horny, and the ...tral one is feathered farther down. The *laminæ* are ...ant, and the lower ones particularly prominent, with ...tting edges. As in the other Oidemiæ, the bill and forehead are inflated, causing the head to appear lengthened and the crown depressed. The *nostrils* are rather large, and nearer to the point than to the rictus. Length 24 inches. (Dr. Richardson, from a bird killed at Fort Franklin.)

Female and Young.—Black ashy brown wherever the male is deep black. *Head* and *neck* lighter; frontal band and great angular space upon the nape indicated by very bright ashy brown. Lateral protuberances of the *bill* but little developed, and the whole bill of an ashy yellowish colour. *Feet* and *toes* brown; *webs* black. (Temminck.) Dr. Richardson observes that the under plumage in particular is paler, that the *back* and *wing coverts* are narrowly edged with grey, that the *breast, flanks*, and *ears* have some whitish edgings, that the *bill* is black, its base not so much inflated, and that the nostrils are smaller than in the male.

Geographical Distribution.—Rare and accidental in the Orcades, and in the higher latitudes towards the pole; very rare in the cold and temperate countries bathed by the ocean; very common and numerous in America, at Hudson's and Baffin's Bays. Such is Temminck's account. Nuttall says that this species of duck, with other dark kinds commonly called on the other side of the Atlantic 'coots,' may be properly considered as an American species; its visits in the Orkneys and European seas being merely accidental. They breed on the Arctic coasts, and extend their residence to the opposite side of the continent, having been seen at Nootka Sound by Captain Cook. The bird is not mentioned in the notice of the animals which were met with during the period in which the expedition remained within the Arctic Circle, appended to Captain Sir W. E. Parry's First Voyage, nor in Captain James Ross's Appendix to Captain Sir John Ross's Last Voyage. The Prince of Musignano notes it as very common, and most abundant in the sea in the neighbourhood of the shore at Philadelphia.

Habits, Reproduction, &c.—In summer the *Surf Duck* feeds principally in the sea, and haunts shallow estuaries, bars and bays, where it may be seen constantly diving for its shelly food. The surf is a favourite station with it. Hudson's Bay and Labrador are among its breeding places, and the nest is formed of grass with a lining of down or feathers on the borders of fresh-water ponds. The eggs are white, and from four to six in number. The young are hatched in July, and detained on the borders of the ponds, where they were excluded from the egg, until they are able to fly. Their migrations extend to Florida, but they often remain throughout the winter along the shores and open bays of the United States. At the end of April or early in May they again proceed northward.

Utility to Man.—The flesh of the old birds is very dark, red, and fishy when dressed; the young are of better flavour. They are however often eaten by the inhabitants of the coasts frequented by them; and being difficult to approach, they are decoyed by means of a wooden figure of a duck of the same general appearance with themselves.

Oidemia perspicillata, Male.

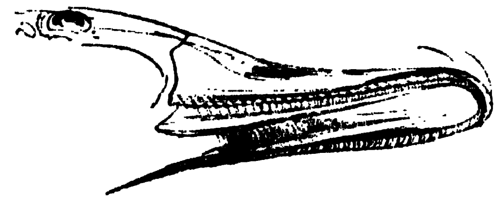
Fuligula. (Ray.)

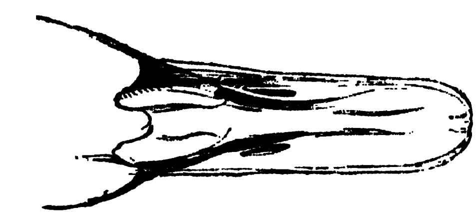
Generic Character.—*Bill* flat, broad, long, with hardly any gibbosity at the base, and rather dilated at the extremity. *Nostrils* suboval, basal. *Tail* short, of 14 feathers, graduated laterally. First *quill* longest.

The sea, and its bays and estuaries, are the principal haunts of this genus. Dr. Richardson states that *Fuligulæ Valisneria, ferina, marila*, and *rufitorques*, breed in all parts of the fur countries, from the 50th parallel to their most northern limits, and associate much on the water with the *Anatinæ*. *Fuligula rubida*, he remarks, frequents the small lakes of the interior up to the 58th parallel, and he adds that it is very unwilling to take wing, and dives remarkably well. In swimming, according to the same observer, it carries its tail erect, and, from the shortness of its neck, nearly as high as its head, which, at a little distance, causes it to appear as if it had two heads. The Canvass-back Duck, *Fuligula Valisneria**, *Anas Valisneria* of Wilson, may be selected as an illustration of the genus.

Description.—The following accurate description of a male, killed on the Saskatchewan on the 3rd of May, 1827, is given by Dr. Richardson in 'Fauna Boreali-Americana.' *Colour.*—Region of the *bill*, top of the head, chin, base of the neck, and adjoining parts of the breast and back, rump, upper and under tail-coverts, pitch-black; sides of the head and the neck reddish-orange; middle of the back, scapulars, wing-coverts, tips of the secondaries, tertiaries, flanks, posterior part of the belly and thighs, greyish-white, finely undulated with hair-brown; primaries and their coverts hair-brown, their tips darkest; secondaries ash-grey, tipped with white; the two adjoining tertiaries edged with black. *Belly* white, faintly undulated on the medial line. In some specimens the white parts are glossed with ferruginous. *Bill* and *legs*, blackish-brown. *Form.*—*Bill* lengthened, the depressed frontal angle longer, the nostrils farther from the front, and the unguis differently shaped and smaller than in *Fuligula ferina* (the Pochard); the *upper laminæ* flat, cuneate, not prominent, and confined within the margin of the mandible. The bill and head of the Canvass-back approach somewhat to the form of the *Pintail Duck*, being much lengthened, and of equal breadth throughout. *First quill* the longest. Length, 24 inches 6 lines.

Female.—Ground colour of the upper plumage and flanks liver-brown: sides of the head, neck, and breast, ferruginous; shoulders, shorter scapulars, and under plumage edged with the same. Middle of the back and wing-covert clove-brown, finely undulated with greyish white. There are no undulated markings on the tertiaries and secondaries, and only a few on the tips of the scapulars. *Bill* as in the male: the neck more slender. (Dr. Richardson.)





Bill of Canvass-back Duck.

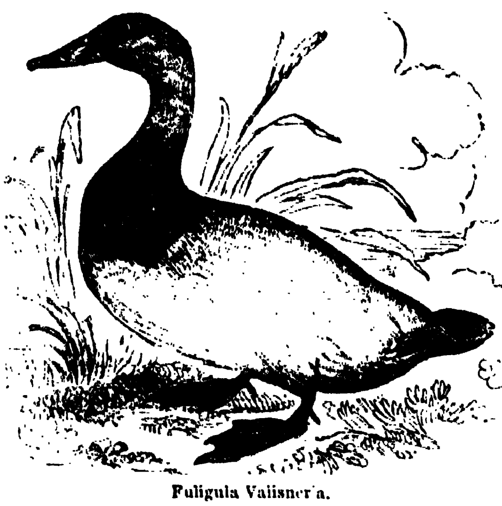
Geographical Distribution.—We have above given Dr. Richardson's account of its breeding from the 50th parallel to the most northern limits of the fur countries. When the work of incubation is past, flocks of Canvass-backs pursue their course to the southward, and arrive about the middle of October on the sea-coasts of the United States. The Hudson, the Delaware, and the bays of North Caro-

* Genus Aithya (Boié).

lina, are visited by some of these flocks; and it is stated that they are abundant in the river Neuse, in the vicinity of Newbern, and probably in most of the other southern waters down to the coast of the Gulf of Mexico, being seen in winter in the mild climate of New Orleans, at which season a few pairs arrive in Massachusetts Bay, near Cohasset and St. Martha's Vineyard. But it is to Chesapeake Bay, its æstuaries and rivers, among which the Susquehanna, the Patapsco, James's River, and the Potomac, may be particularly mentioned, that the great multitude of Canvass-back Ducks resort.—(Wilson; Nuttall.)

Habits, Food, &c. The canvass-backs associate with the pochards, and are waited upon by the bald-pates or wigeons (*Mareca Americana*), which rob them in the manner described in the article DUCKS (vol. ix. p. 183). They are named in different parts of the Union white-backs and sheldrakes, as well as canvass-backs. *Zostera marina* and *Ruppia maritima* form their food, as well as the fresh-water *Valisneria*, which last is limited in its distribution. The sea-wracks or eel-grass, as the long marine vegetables above alluded to are called in America, are widely spread over the Atlantic, and over the mud-flats, bays, and inlets where salt or brackish water finds access. The canvass-backs dive for and generally pluck up the sea-wrack, and feed only on the most tender portion near the root. They are very shy birds, and most difficult to be approached. Various stratagems are resorted to for getting within gunshot of them; and in severe winters artificial openings are made in the ice, to which the ducks crowd and fall a sacrifice to their eagerness to obtain food. That they will eat seeds and grain as well as sea-wrack, &c., was proved by the loss of a vessel loaded with wheat near the entrance of Great Egg Harbour, New Jersey, to which great flocks of canvass-backs were attracted. Upon this occasion as many as 240 were killed in one day. (Wilson; Nuttall.)

Utility to Man.—The canvass-back, which is lean on its first arrival in the United States, becomes, in November, about three pounds in weight, and in high order for the table: there are few birds which grace the board better. The Prince of Musignano is eloquent in its praise: 'Carne della massima squisitezza, grandemente ricercata dai gastronomi. La migliore delle Anitre. Forse il miglior uccello d'America.' Any attempt to introduce the bird into England would, it is feared, prove a failure: for even if the ordinary difficulties should be got over, the absence of the food to which it is supposed to owe its exquisite flavour would render the success of the experiment very doubtful.*

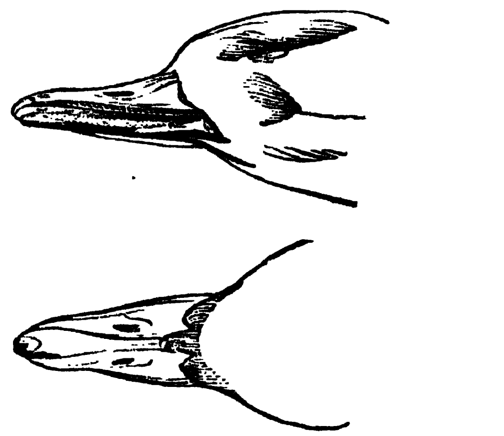


Fuligula Valisneria.

Clangula (Boié).

Bill narrow, elevated at the base, somewhat attenuated at the anterior extremity, and short. *Nostrils* inclining to oval, submesial, or rather anterior to the middle of the bill. *Tail* rather long, of 16 feathers generally.

Though many of this genus frequent the sea, the species are more generally met with in the fresh waters than the other Sea Ducks. Thus Dr. Richardson remarks that *Clangula vulgaris* (Common Golden Eye) and *albeola* (Spirit Duck) frequent the rivers and fresh-water lakes throughout the fur countries in great numbers. They are, as he states, by no means shy, allowing a near approach to the sportsman; but at the flash of a gun or even at the twang of a bow, they dive so suddenly that they are seldom killed. Hence the natives impute supernatural powers to them, as the appellations of 'Conjuring Ducks' and 'Spirit Ducks' sufficiently testify. Dr. Richardson says that the manners of *Clangula Barrovii* (Richardson and Swainson), described in 'Fauna Boreali-Americana,' and which has hitherto been found only in the valleys of the Rocky Mountains, do not differ from those of the Common Golden Eye. He speaks of *Clangula histrionica* as haunting eddies under cascades and rapid streams, as very vigilant, taking wing at once when disturbed, as rare, and as never associating, as far as he saw, with any other bird. The high northern latitudes may be considered generally as the localities of this genus,* which we proceed to illustrate by *Clangula albeola*, *Anas albeola* of Linnæus, the *Spirit Duck.*



Bill of Clangula albeola.

This is the *Buffel Duck* of Pennant; the *Buffel's Head Duck* of Catesby; the *Little black and white Duck* of Edwards; the *Buffel-headed Duck* of Wilson; *Wakaisheeweesheep*, *Waw haisheep*, and *Wappano-sheep* of the Cree and Chippeway Indians.

Dr. Richardson thus describes a male and female killed on the Saskatchewan in May, 1827.

Male.—Colour. Forehead, region of the bill, nuchal crest, and upper sides of the neck rich duck green, blending with the resplendent auricula-purple of the top of the head and throat. Broad band from the eye to the tip of the occipital crest, lower half of the neck, the shoulders, exterior scapulars, intermediate and greater coverts, outer webs of five or six secondaries, flanks, and under plumage to the vent pure white. Back, long scapulars, and tertiaries velvet black; lesser coverts bordering the wing the same, edged with white; primaries and their coverts brownish-black. Tail-coverts blackish-grey; tail broccoli-brown. Vent and under tail-coverts greyish. *Bill* bluish-black. *Legs* yellowish. In many spring specimens the under plumage is ash grey. *Form.—Bill* smaller in proportion than that of the common Garrot, and the nostrils nearer the base; but otherwise similar. *Head* large, with the upper part of the neck clothed in velvety plumage, rising into a short thick crest. Wings two inches and a half shorter than the tail. *Tail*—lateral feathers graduated, three middle pairs even. Length sixteen inches; but individuals differ in size.

Female.—Considerably smaller. Head and dorsal plumage dark blackish-brown; the forepart of the back, scapulars, and tertiaries, edged with yellowish brown. Fore part of the neck, sides of the breast, flanks, and vent-feathers, blackish-grey; breast and belly white, glossed with brownish-orange. White band on the ears and occiput much narrower than in the male. The white speculum is less perfect, and the whole of the lesser coverts and scapulars are unspotted blackish-brown. *Bill* and *feet* brownish. Total length fourteen inches and a half.

Young males resemble the females. ('Fauna Boreali-Americana.')

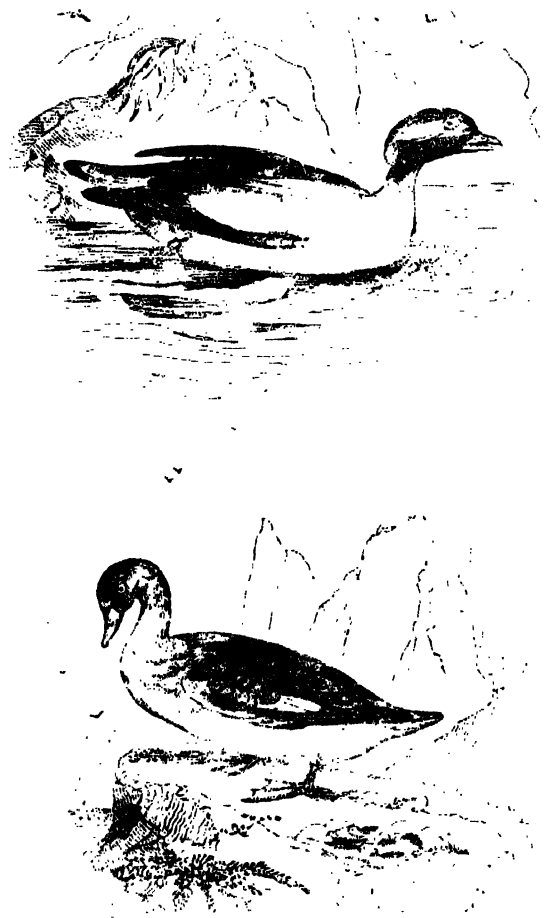
* The Western Duck (*Fuligula Stelleri*) has been elevated to a genus by Brehm under the name of *Callicher*.

* The Common Golden Eye, or Garrot (*Clangula vulgaris*, *Anas Clangula*, Linn.) is an inhabitant of the Arctic regions of the new and old worlds, and frequently met with in this country, and in Europe generally. The species is distributed over the Swiss lakes. Mr. Gould figures Clangula Barrovii and Clangula histrionica among the Birds of Europe, the former having been shot in Iceland by T. C. Atkinson, Esq., and the latter having been frequently captured in the British Islands.

Geographical Distribution.—**Abundant in the summer on the rivers and fresh-water lakes of the fur countries. In autumn and winter very common in the United States, sometimes on the sea-shores. Catesby says that the Buffel's Head Duck appears in Carolina during the winter only. On the river Neuse, in North Carolina, they have been seen in abundance in February. In April and May those in the south take their departure northward.**

Habits, Food, Re-production.—This species is a most expert diver, whether it resorts to that feat as a mode of escape, or as the means of procuring the sea-wrack and laver (*Ulva lactuca*), and crustaceans and mollusks, which, at particular seasons of the year when it visits the sea bays and salt marshes, form its favourite food. The rapidity of its disappearance from the surface, and the artful way in which it conceals itself after it has vanished under water, have earned for it the appropriate name of 'Spirit Duck,' or 'Conjurer.' A bird is rarely hit, and when it is, if not killed outright, it can rarely be captured; so quick is the Spirit Duck in avoiding the shot altogether, and so dexterous in evading its pursuer, if only wounded. About Hudson's Bay they are said to form their nests in hollow trees in woods adjacent to water. (Wilson; Nuttall).

Utility to Man.—The flesh of the Spirit Duck is not in high repute but the females and young are tender and well-flavoured in the winter. The bird becomes so fat that, in Pennsylvania and New Jersey, it is commonly called 'Butter-Box,' or 'Butter-Ball.'

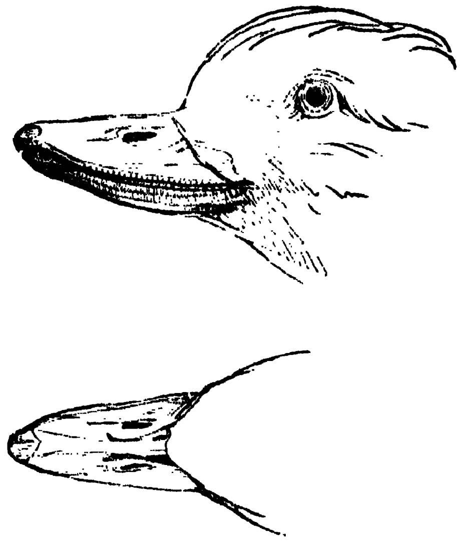


Clangula albeola, male and female.

Harelda. (Leach).

Generic Character.—*Bill* very short, high at the base, nail broad and arched. *Laminæ* prominent, trenchant, and distant; the upper laminæ projecting below the margin of the mandible, the lower laminæ divided into a nearly equal double series. *Nostrils* oblong, large, and nearly basal. Forehead high; neck rather thick. *Tail* very long, of fourteen feathers. *Toes* short.

Example, *Harelda glacialis, Anas glacialis*, Linn., the *Long-tailed Duck.*



Bill of Harelda glacialis.

This is the *Canard à longue Queue, ou Canard de Miclon* of the French; *Eisente, Winter Ente* of the Germans; *Ungle, Angeltaske, Trasfoener* of the Norwegians; *Oedel* of the Feroe Islanders; *Ha-Old, Ha-Ella* of the Icelanders; *Swallow-tailed Sheldrake, Sharp-tailed Duck, Calao, Calaw, Coal and Candle Light* of the modern British; *Hwyad gynffon gwennol* of the antient British; *Old Wife* and *Swallow-tailed Duck* of the Hudson's Bay residents; *South-Southerly* of the United States; *Ahdggee-areoo* of the Esquimaux; *Caccâwee* of the Canadian voyageurs; and *Hahhaway* of the Cree Indians.

Description.—Old Male (Winter). Summit of the head, nape, front, and lower parts of the neck, long scapulars, belly, abdomen, and lateral tail feathers, pure white; cheeks and throat ash-colour; a great space of maroon brown on the sides of the neck; breast, back, rump, wings, and the two long feathers of the middle of the tail brownish; flanks ash-coloured; the black of the bill cut transversely by a red band; tarsi and toes yellow; webs blackish; iris orange. Length, comprising the long tail-feathers, twenty to twenty-one inches.

Old Female. Differing much from the male. Tail short, the feathers bordered with white and the two middle ones not elongated; forehead, throat, and eyebrows whitish ash; nape, front, and lower part of the neck, belly, and abdomen pure white; top of the head and great space at the sides of the neck blackish ash; breast variegated with ash colour and brown; feathers of the back, scapulars, and wing-coverts black in the middle, bordered and terminated with ashy-red; rest of the other parts brown; the bluish colour of the bill cut by a yellowish band; iris bright brown; feet lead-colour. Length 16 inches.

Young of the Year. Not differing much from the old female; the whiteness of the face is varied with numerous brown or ash-coloured spots; throat, front of the neck, and nape ashy-brown; lower part of the neck, a large spot behind the eyes, belly, and abdomen white; breast and thighs variegated with brown and ash-coloured spots. (Temminck.)

Summer Dress.—Male, killed May 1, 1826, on the Saskatchewan. *Colour.*—The whole upper plumage, the two central pairs of tail feathers, and the under plumage to the fore part of the belly brownish-black; the lesser quills paler. A triangular patch of the feathers between the shoulders, and the scapulars, broadly bordered with orange brown. Sides of the head from the bill to the ears ash-grey; eye-stripe and posterior under plumage pure white. Flanks, sides of the rump, and lateral tail-feathers white, stained with brown; axillaries and inner wing-coverts clove-brown. *Bill* black, with an orange belt before the nostrils. *Legs* dark-brown. Specimens killed a fortnight or three weeks later in the season at Bear Lake, on their way to the breeding-places, differed in having a large white patch on the hind head and occiput, with scattered white feathers on the neck and among the scapulars; the sides under the wings pure pearl grey, and the sides of the rump unstained white. (Dr. Richardson, 'Fauna Boreali-Americana.')

Captain, now Major, Edward Sabine (Supplement to Appendix of Captain Sir W. E. Parry's First Voyage) notices

a male obtained in June, corresponding precisely with the individual killed in Baffin's Bay in the summer of 1818, which furnished the description of the full breeding plumage in the 'Memoir of the Greenland Birds.' An account, adds the author, of this state of plumage is yet wanting to complete the history of this species in M. Temminck's second edition. The plumage of a young male killed on the 22nd of June corresponded precisely with M. Temminck's male of one or two years old. Dr. Richardson observes (*loc. cit.*) that Captain Sabine describes the plumage of the specimens killed at Bear Lake as the pure breeding plumage; but individuals coloured like the one killed on the Saskatchewan are, he remarks, often seen at the breeding stations. He quotes Mr. Edwards, surgeon of the Fury (Sir W. E. Parry's 2nd Voyage), as describing the Long-tailed Ducks killed at Melville Peninsula between the 1st and 25th of June as follows:—They had all a dark silky chestnut-brown patch on the side of the neck; a mixture of white in the black stripe from the bill to the crown; the crown and nape either entirely white, or mixed with black; scapulars and upper tail-coverts edged with white; a broad white collar round the lower part of the neck, in some individuals tipped with black or brown; occasionally a white band on the breat. The colour of the belt on the bill varied from rose-red to violet.

Mature Female, killed May 25, lat. $65\frac{1}{2}$°. *Upper plumage* and sides of the breast pale liver-brown, with dark centres; the wing-coverts, scapulars, and hinder parts mostly edged with white. Top of the head blackish-brown, its sides anteriorly broccoli-brown; ears and base of the neck below clove brown. A spot at the base of the bill and a stripe behind the eye white. Throat and collar ash-grey. Tail-feathers brownish-grey, edged with white, short and worn. (Dr. Richardson.)

Geographical Distribution.—The Arctic seas of both worlds. An accidental visitor on the great lakes of Germany, and along the Baltic. Often, but never in flocks, on the maritime coasts of Holland. (Temminck.) Abundant in Sweden, Lapland, and Russia. (Gould.) Noted in the list of birds seen within the Arctic Circle and as breeding in the North Georgian Islands, but not common there. (Supplement to Appendix to Captain Parry's First Voyage.) Females taken in Duke of York's Bay. (Captain Lyon's Journal.) Abundant on the Arctic Sea, associating with the *Oidemiæ*, remaining in the north as long as it can find open water, and assembling in very large flocks before migrating. Halts, during its progress southwards, both on the shores of the Hudson's Bay and in the inland lakes, and is one of the last of the birds of passage which quits the fur countries. (Dr. Richardson, 'Fauna Boreali-Americana.') Captain James Ross describes it as the most noisy and most numerous of the ducks that visit the shores of Boothia. (Appendix to Captain Sir John Ross's Last Voyage.) The species is abundant in Greenland, Lapland, Russia, and Kamtchatka, and flocks pass the winter (from October to April) at the Orkney Islands. They are seldom seen in the southern parts of England, unless the weather be very severe. In October they visit the United States, and abound in Chesapeake Bay.

Habits, Food, Reproduction, &c.—Lively, most noisy, and gregarious, the Long-tailed Duck, with its swallow-like appearance in flight, swims and dives with all the expertness of the Spirit Ducks. Dr. Richardson states that in the latter end of August, when a thin crust of ice forms during the night on the Arctic Sea, the female may be often seen breaking a way with her wings for her young brood. The same author states that the eggs are pale greenish-grey, with both ends rather obtuse, 26 lines long and 18 wide. They are about five in number; and in Spitzbergen, Iceland, and along the grassy shores of Hudson's Bay, near the sea, this species is said to form its nest, about the middle of June, lining the interior with the down of the breast. Marine productions principally, both animal and vegetable, form its food, particularly the *Zostera*, or Grass-wrack, for which it dives like others of its congeners. 'Late in the evening, or early in the morning,' writes Nuttall in his *Manual*,* 'towards spring more particularly, vast flocks are seen in the bays and sheltered inlets, and in calm and foggy weather we hear the loud and blended nasal call reiterated for hours from the motley multitude. There is something in the sound like the honk of the goose, and, as far as words can express a subject so uncouth, it resembles the guttural syllables *ogh, ough, egh,* and then *ogh, ogh, ogh, ough, egh,* given in a ludicrous drawling tone; but still, with all the accompaniments of scene and season, this humble harbinger of spring, obeying the feelings of nature, and pouring forth his final ditty before his departure to the distant north, conspires, with the novelty of the call, to please rather than disgust those happy few who may be willing to find "good in everything."'

Utility to Man.—The old birds are not considered as of much value for the table; but the young birds are tender and juicy. If, as is on good authority asserted, the down which the *Long-tailed Duck* strips from its breast as a lining for the nest is as soft and elastic as that of the *Eider Duck*, it may considered as offering no mean contribution to the comforts of man, a contribution which, however apparently hitherto neglected, deserves the attention of the intelligent and enterprising.

Harelda glacialis: male and female.

In addition to the genera above-mentioned, *Gymnura* (*Oxyura* of Bonaparte), *Macropus*, and *Micropterus* find a place among the *Sea Ducks*.

The species from which the genus *Oxyura* is established is bred, according to Nuttall ('Manual'), in the north, and principally haunts fresh-water lakes, diving and swimming with great ease, but it is averse to rising into the air. It is small, and is said, by the last-named author, to be nearly allied to *Anas leucocephala*, which inhabits the saline lakes and inland seas of Siberia, Russia, and the east of Europe; and also to have an affinity with *A. Jamaicensis* of Latham. Nuttall thinks that it is perhaps identical with *A. spinosa* of Guiana, if not also with *A. Dominica* of Gmelin, a native of St. Domingo, and probably only resident there during the winter. He also observes that the name of *Oxyura* having been previously employed for a sub-genus of Creepers, it was necessary to alter it; but the student should remember that *Gymnura* had been preoccupied by Sir Stamford Raffles for a genus of mammifers; and that Spix has named a family of South American monkeys *Gymnuri*. The Prince of Musignano, however, corrected

* 'Manual of the Ornithology of the United States and of Canada,' 2 vols., 8vo., Boston. A most useful and interesting book.

himself and changed the name to *Erismatura.* Mr. Gould gave the name of *Undina* to the genus, and figures the European species under the name of Undina leucocephala.

It should be remembered that the subgeneric term *Macropus* has been long applied as a generic name for the Kangaroos.

Micropterus is the genus containing the well-known *Race-Horse* of Cook (*Micropterus brachypterus, Anas brachyptera* of authors). Captain Phillip Parker King, R.N., who has added a second species (*Micropterus Patachonicus*), gives these short-winged but rapidly progressing Sea Ducks the familiar name of Steamer Ducks or Steamers.

At a meeting of the Zoological Society, in December 1837, Mr. T. C. Eyton made some observations on the *Anatidæ*, which family he regarded as connected with the *Grallatorial Birds* by means of the *Flamingo* on the one side and the *semipalmated Goose* on the other, with the *Divers* of the family *Alcadæ* by the *Mergansers*, and also with the *Cormorants* through the *Erismaturinæ*. Mr. Eyton divides the *Anatidæ* into the subfamilies *Plectropterinæ, Anserinæ, Anatinæ, Fuligulinæ, Erismaturinæ*, and *Merginæ*.

The *Anatinæ*, according to Mr. Eyton, contain the following genera: *Tadorna*, Leach; *Casarka*, Bonaparte; *Dendrocygna*, Swainson; *Leptotarsis*, Gould (*L. Eytoni*); *Dafila*, Leach; *Mareca*, Stephens; *Aia*, Boié (Anas sponsa, Linn.); *Pœcilonetta*, Eyton (*Anas marmorata*, Temm.); *Querquedula*, Auct.; *Cyanopterus* (*Anas Rafflesii*, King); *Rhynchaspis*, Leach; *Malacorhynchus*, Swainson; *Chauliodus*,* Swainson; *Anas*, Auct.; *Carina*, Fleming.

Mr. Eyton's *Fuligulinæ* consist of the genera *Micropterus*, King; *Melanitta*, Boié; *Somateria*, Leach; *Polysticta*, Eyton (Anas dispar, Gmel.); *Kamptorhynchus*, Eyton (*Anas Labradora*, Wilson); *Callicher*, Brehm; *Fuligula*, Ray; *Nyroca*, Fleming; *Harelda*, Leach; and *Clangula*, Leach.

Mr. Eyton stated, that characters of the genera and species would be given in his forthcoming monograph on the *Anatidæ*.

FULLER, THOMAS, was the son of the Rev. Thomas Fuller, rector of Aldwincle, in Northamptonshire, where he was born in 1608. He was educated under his father, and was sent at the early age of twelve years to Queen's College, Cambridge. He became B.A. in 1625, and M.A. in 1628, but afterwards removed to Sidney College, where he obtained a fellowship in 1631, and nearly at the same time the prebend of Netherby, in the church of Salisbury. In this year also he issued his first publication, a poem, now little known, entitled 'David's Hainous Sin, Hearti Repentence, Heavie Punishment,' in 12mo. He was soon after ordained priest, and presented to the rectory of Broad Windsor, in Dorsetshire: but growing weary of a country parish, and uneasy at the unsettled state of public affairs, he removed to London, and distinguished himself so much in the pulpits there, that he was invited by the master and brethren of the Savoy to be their lecturer. In 1639 he published his 'History of the Holy War:' it was printed at Cambridge, in folio, and so favourably received that a third edition appeared in 1647. On April 13, 1640, a parliament was called, and a convocation also began at Westminster, in Henry VIIth's chapel, having licence granted to make new canons for the better government of the church: of this convocation he was a member, and has detailed its proceedings in his 'Church History.' During the commencement of the Rebellion, and when the king left London, in 1641, to raise an army, Mr. Fuller continued at the Savoy, to the great satisfaction of his congregation and the neighbouring nobility and gentry, labouring all the while in private and in public to serve the king. On the anniversary of his inauguration, March 37, 1642, he preached at Westminster Abbey on this text, 2 Sam. xix. 30, 'Yea, let him take all, so that my lord the king return in peace,' which, being printed, gave great offence to those who were engaged in the opposition, and exposed the preacher to a good deal of danger.

In 1643, refusing to take an oath to the parliament, unless with such reserves as they would not admit, in April of that year he joined the king at Oxford, who, having heard of his extraordinary abilities in the pulpit, was desirous of knowing them personally, and accordingly Fuller preached before him at St. Mary's Church. He had before preached and published a sermon in London, upon the 'new-moulding church-reformation,' which caused him to be censured as too hot a royalist; and now, from his sermon at Oxford, he was thought to be too luke-warm, which can only be ascribed to his moderation, which he would sincerely have inculcated upon each party as the only means of reconciling both. During his stay here, his residence was in Lincoln College, but he was not long after sequestered, and lost all his books and manuscripts. This loss, the heaviest he could sustain, was made up to him partly by Henry Lord Beauchamp, and partly by Lionel Cranfield, earl of Middlesex, who gave him the remains of his father's library. That, however, he might not lie under the suspicion of want of zeal or courage in the royal cause, he determined to join the army, and therefore, being well recommended to Sir Ralph Hopton in 1643, he was admitted by him in quality of chaplain. For this employment he was at liberty, being deprived of all other preferment. Though he attended the army from place to place, and constantly exercised his duty as chaplain, he yet found proper intervals for his favorite studies, which he employed chiefly in making historical collections, and especially in gathering materials for his 'Worthies of England,' which he did, not only by an extensive correspondence, but by personal inquiries in every place which the army had occasion to pass through.

After the battle at Cheriton-Down, March 29, 1644, Lord Hopton drew on his army to Basing-House, and Fuller, being left there by him, animated the garrison to so vigorous a defence of that place, that Sir William Waller was obliged to raise the siege with considerable loss But the war coming to an end, and part of the king's army being driven into Cornwall under Lord Hopton, Fuller, with the permission of that nobleman, took refuge at Exeter, where he resumed his studies, and preached constantly to the citizens. During his residence here he was appointed chaplain to the infant princess, Henrietta Maria, who was born at Exeter in June, 1643. He continued his attendance on the princess till the surrender of Exeter to the parliament, in April, 1646. He is said to have written his 'Good Thoughts in Bad Times' at Exeter, where the book was published in 1645, 16mo. On the garrison being forced to surrender, he came to London, where he found his lectureship at the Savoy filled by another. It was not long however before he was chosen lecturer of St. Clement's, near Lombard Street, and shortly afterwards removed to St. Bride's, Fleet Street. In 1647 he published, in 4to., 'a Sermon of Assurance, fourteen years ago preached at Cambridge, since in other places, now by the importunity of his friends exposed to public view.' He dedicated it to Sir John Danvers, who had been a royalist, was then an Oliverian, and next year one of the king's judges: and in the dedication he says, that 'it had been the pleasure of the present authority to make him mute, forbidding him, till further order, the exercise of his public preaching.' Notwithstanding his being thus silenced, he was, about 1648, presented to the rectory of Waltham Abbey, in Essex, by the earl of Carlisle. In 1648 he published his 'Holy State,' folio, Cambr. His 'Pisgah-sight of Palestine and the Confines thereof, with the History of the Old and New Testament, acted thereon,' was published, fol. Lond. 1650, and reprinted in 1662. At this period he was still employed upon his 'Worthies.' In 1651 he published 'Abel Redivivus, or the Dead yet Speaking; the Lives and Deaths of the Modern Divines.' Lond. 4to. In the two or three following years he printed several sermons and tracts upon religious subjects: 'The Infant's Advocate,' 8vo. Lond. 1653; 'Perfection and Peace, a Sermon,' 4to. Lond. 1653 'A Comment on Ruth, with two Sermons,' 8vo. Lond. 1654; 'A Triple Reconciler,' 8vo. Lond. 1654. About this last year he took as a second wife a sister of the Viscount Baltinglasse. In 1655, notwithstanding Cromwell's prohibition of all persons from preaching or teaching school who had been adherents to the late king, he continued preaching and exerting his charitable disposition towards those ministers who were ejected, as well as towards others. In 1655 he published in folio 'The Church History of Britain, from the birth of Jesus Christ until the year MDCXLVIII.,' to which he subjoined 'The History of the University of Cambridge since the Conquest,' and 'The History of Waltham Abbey, in Essex, founded by King Harold.' The Church History was animadverted upon by Dr. Peter Heylyn in his 'Examen Historicum,' to which

* Pre-occupied by Schneider for a genus of Fishes—Chauliodus Sloani, Schn., Esox stomias, Sh.

Fuller replied in his 'Appeal of Injured Innocence,' fol. Lond. 1659. It is said that Lord Berkeley, in 1658 or 1659, took him over to the Hague, and introduced him to Charles II. It is certain however that a short time before the Restoration he was re-admitted to his lecture in the Savoy, and on that event restored to his prebend of Salisbury. He was chosen chaplain extraordinary to the king; and created D.D., at Cambridge, by a mandamus dated Aug. 2, 1660. Upon his return from Salisbury, in August, 1661, he was attacked by a fever, of which he died on the 15th of that month. His funeral was attended by at least two hundred of his brethren of the ministry. He was buried in his church of Cranford, on the north wall of the chancel of which his monument is still remaining. His 'History of the Worthies of England' was not published till after his death, fol. Lond. 1662: reprinted in two volumes, 4to. Lond. 1811, with explanatory notes by John Nichols. The University of Oxford intend publishing another reprint of this work.

Besides the works already mentioned, Fuller was the author of several others of a smaller kind. 1. 'Andronicus, or the Unfortunate Politician,' 12mo. Lond. 1646. 2. 'Good Thoughts in Worse Times,' 16mo. Lond. 1647, reprinted with his 'Good Thoughts in Bad Times,' 1652, and again, 12mo. Lond. 1669, and both since reprinted at Oxford; 3. 'Mixt Contemplations in Better Times,' 12mo. Lond. 1660; 4. 'The Speech of Birds, also of Flowers, partly moral, partly mystical,' 8vo. 1660. In 1651 he published Dr. Holdsworth's 'Valley of Vision,' with a preface. A specimen of his Latin composition, in what is called 'An Eccho,' occurs in the first book of 'Ayres and Dialogues, for one, two, and three Voyces,' by Henry Lawes, fol. Lond. 1653. Fuller was a man of great wit, and of powers of memory almost incredible. (*Life of Dr. Thomas Fuller*, 12mo. Lond. 1661; *Biogr. Britan.*, vol. iii. 2049—2069: Chalmers's *Biogr. Dict.*, vol. xv. p. 168—176.)

FULLERS' EARTH, a mineral product, formerly much used in the fulling of cloth, whence it derives its name. It occurs massive, and is usually of a greenish brown or dull grey colour; sometimes it is nearly of a slate colour. It is opaque, dull, and its specific gravity is 1·8, 2·2. Greasy and soft, yielding to, and polished by, the nail. Fracture uneven, earthy; in water it breaks down into a soft pulpy mass. Before the blow-pipe it fuses into a white blobby glass.

It is found at Nutfield, near Reigate, in Surrey, and occurs in regular beds near the summit of a hill, between beds of sand or sandstone, containing fossil wood, cornua ammonis, &c. There are two distinct beds of fullers' earth; the upper has a greenish colour, is five feet in thickness, and rests upon the other, which has a bluish tint, and is eleven feet thick; in these beds, but especially in the latter, there are found considerable masses of sulphate of barytes, frequently in regular crystals. Fullers' earth is also found in Kent, Bedfordshire, Bath, Nottinghamshire, and Sussex. It is met with also in Styria, Saxony, and some other places.

According to Dr. Thomson's analysis, this substance consists of

Silica	44	
Alumina	23·06	
Lime	4·08	
Magnesia	2·00	
Protoxide of iron	2·00	
Water	24·95	
		100·09

Dr. Thomson observes that, allowing the lime, magnesia, and protoxide of iron, to be in the state of silicates, and as mere accidental constituents, fullers' earth is a hydrous bisilicate of alumina, consisting of 2 equivalents of silica, 1 equivalent of alumina, and two equivalents of water.

FULLING. [WOOLLEN MANUFACTURES.]

FULMINATING POWDERS. [DETONATION.]

FULMINIC ACID. An acid which appears to be isomeric with cyanic acid [CYANIC ACID], that is, composed of the same elements in the same proportions, and they appear to have similar saturating powers. Fulminic acid is that which exists in the detonating mercury and silver discovered by Mr. Howard. These fulminates, as shown under the respective metals, are prepared by the simultaneous action of nitric acid and alcohol upon them: in this operation the metals are oxidized, and such portions of the carbon, of the alcohol, and azote and oxygen of the decomposed nitric acid combine, as to form the fulminic acid, which may be regarded as composed of

$$\left.\begin{array}{ll}\text{Two equivs. of carbon} & 12\\ \text{One do. azote} & 14\end{array}\right\} = \text{One equiv. cyanogen} \quad 26$$

$$\text{One do. oxygen} \quad 8$$

$$\text{Equivalent} \quad 34$$

The subject of the perfect identity of the cyanic acid and fulminic acid is, however, obscure; and as their combining weight is similar, we have not the resource available in the case of the isomeric carburetted hydrogens, of supposing that they consist of the same proportions, but of a different number of equivalents of the same elements. Fulminic acid may be separated from the oxides of silver and of mercury, and combined with other bases, as with potash, and it still retains its power of forming detonating compounds.

FULTON, ROBERT, distinguished as having been the first to establish steam-navigation on the American seas and rivers, was born in 1765, in Little Britain, Pennsylvania. His parents were emigrants from Ireland. He received a common English education at a village school. Besides a fondness for mechanical pursuits, he early displayed a taste for drawing, and in his eighteenth year went to Philadelphia, and began to paint portraits and landscapes as a means of subsistence.

In November, 1786, he embarked for England, and on his arrival in London was received as an inmate in the house of West, the historical painter, with whom he continued to reside for some years, and who also gave him instructions in his profession.

After leaving West, painting was for some time his chief employment. But with Fulton the fine arts were destined to give place to the mechanical. He spent about two years in Devonshire, where he became acquainted with the Duke of Bridgewater, and projects for the improvement of canals then began to occupy the chief share of his attention. In 1794 he took out a patent for an inclined plane, which was intended to set aside the use of locks; he invented a machine to facilitate excavation, and wrote a work on canals, in which he first styled himself a civil engineer. He also invented a mill for sawing marble, and took out patents for spinning flax and making ropes.

He seems however to have had little success; and at the latter end of 1796 went to Paris, on the invitation of Joel Barlow, then resident minister from the United States, in whose house he resided during seven years. While at Paris two projects appear to have occupied a large portion of his time and attention; one, a carcass, or box filled with combustibles, which was to be propelled under water, and made to explode beneath the bottom of a vessel; the other, a submarine boat, to be used for a similar destructive purpose. The first was a failure; but of his submarine boat he made many trials and exhibitions, some of them at the expense of the French government, with occasional failures and partial success, on the Seine, at Hâvre, and at Rouen. But for all practical purposes this was as much a failure as the other. He appears however to have clung to it with great perseverance, and not long before his death exhibited its power by blowing up an old vessel in the neighbourhood of New York.

But while at Paris he had other and better pursuits. He made himself acquainted with the higher branches o. science, and with the modern European languages: he projected the first panorama exhibited at Paris, and in conjunction with Mr. R. Livingston, the American ambassador, began to make experiments on the Seine with small steamboats: a larger one was built, which broke asunder, but a second, completed in 1803, was successful.

Soon after this time he was invited to England by the English ministry, at the suggestion of Earl Stanhope, with whom Fulton had become acquainted about the time of his introduction to the Duke of Bridgewater. The object of the English ministry appears to have been to employ him in the construction of his submarine implements of war. After some trials on the Thames, the negotiation failed, and Fulton resolved to embark for America.

In 1806 Fulton arrived at New York, and soon after, with funds supplied by Mr. Livingston, commenced the construction of a steam-vessel of considerable size, which began to navigate the Hudson in 1807. He afterwards built others of large dimensions, one of them a frigate, which bore his name. His reputation became established, and his fortune was rapidly increasing, when his patent for steam-vessels, which he had taken out in conjunction with

Mr. Livingston, was disputed, and his opponents were, in a considerable degree, successful. His constitution had been impaired by his numerous labours, and a severe cold which he caught by incautious exposure in giving directions to his workmen, together with the anxiety and fretfulness occasioned by the law-suits about his patent rights, brought his life to a premature termination on the 24th of February, 1815, in his forty-ninth year. His death occasioned extraordinary demonstrations of national mourning in the United States.

In person he was tall, and though slender, well formed. He appears to have been an amiable, social, and liberal man. (*Encyclopædia Americana; Dictionnaire de la Conversation.*)

FUMARIACEÆ, a small natural order of Exogenous plants, consisting of slender-stemmed, herbaceous plants, many of which scramble up others by aid of their twisting leafstalks. They are rather succulent in texture, with watery juice. Their leaves, which have no stipules, are repeatedly divided till the terminal lobes become small ovate leaflets; their flowers, which are extremely irregular, consist of two membranous, minute, ragged sepals, two exterior distinct linear petals, and two others, which hold firmly together at the points; there are six stamens united into two parcels, and the ovary is a one-celled case with one or many seeds, whose placentation is parietal; finally, the seeds consist principally of albumen, in which there ripens a very small embryo. *Fumaria officinalis* is one of the commonest of weeds; many are objects of cultivation by the gardener for the sake of their showy flowers; all are reputed diaphoretics. They only inhabit the cooler parts of the world, alike avoiding extremes of heat or cold. It is probable that notwithstanding the diversity of their appearance they are only a low irregular form of Papaveraceæ.

1 3 2

Corydalis lutea.

1. the two sepals, stamens, and pistil; 2, a longitudinal section of the ovary; 3, a longitudinal section of a seed, showing the ovary: all more or less magnified.

FUMIGATION is the application of the vapour or fumes from metallic or other preparations to the body, with the intention of healing either generally, or particular parts. The vapours of hot vinegar, burning sulphur, and of aromatic vegetable matters, have been long used to counteract unpleasant or unwholesome smells: this is effected chiefly by the formation of such as are stronger. The most important kind of fumigation is that which consists in the employment of such vapours or gases as do not merely destroy unhealthy odours by exciting such as are more powerful, but which by their chemical action convert dangerous miasmata into innocuous matter.

The fumigation of the first kind, that which is intended to produce a healing effect, is now much less employed than formerly: still, however, the bisulphuret of mercury is occasionally used in vapour, as what is termed a mercurial fumigation, in certain forms of syphilis. The use of vinegar, of aromatic pastilles, and even the smoke of burning brown paper, which constitute the second kind of fumigation, does not require any particular notice; their operation can hardly be regarded as any other than that of substituting one smell for another. In the last kind of fumigation three substances have been chiefly employed, and in the gaseous state: first, the vapour of burning sulphur, or sulphurous acid gas, muriatic acid gas, nitric acid gas, and chlorine gas; all but the last of these, or at any rate the first and second named, appear to have been first used and recommended by Dr. James Johnstone of Worcester, about the year 1758; in 1773 Guyton de Morveau also mentioned the application of muriatic and nitric acid gases, and in 1802 their use was still further extended by Dr. J. C. Smith, who received a public remuneration as the discoverer, which he certainly was not.

Chlorine gas, which is undoubtedly preferable to any disinfectant, was first recommended by Dr. Rollo, who published a work on diabetes in 1797; he liberated the gas by the usual method of mixing sulphuric acid, binoxide of manganese, and common salt. When it is desirable to produce a great effect in a short time, this is still unquestionably the best mode of proceeding.

We shall give an abstract of the mode adopted by Mr. Faraday in fumigating the Penitentiary at Milbank in 1825. (*Quarterly Journal*, vol. xviii., p. 92.)

The space requiring fumigation amounted to nearly 2,000,000 cubic feet: and the surface of the walls, floors, ceilings, &c., was about 1,200,000 square feet. This surface was principally stone and brick, most of which had been lime-washed. A quantity of salt reduced to powder was mixed with an equal weight of binoxide of manganese, and upon this mixture were poured two parts of sulphuric acid, previously diluted with one part of water, and cold. The acid and water were mixed in a wooden tub, the water being first put in, and it being more convenient to measure than to weigh the water and acid, ten measures of water and nine of acid were used; half the acid was first used, and when the mixture had cooled the remainder was added.

Into common red earthen pans, each capable of holding about a gallon, were put 3½ lbs. of the mixed salt and manganese, and there was then added such a measure of the diluted acid as weighed 4½ lbs.; the mixture was well stirred and then left to itself, and all apertures were well stopped. The action did not commence immediately, so that there was sufficient time for the operator to go from pan to pan without inconvenience. On entering a gallery 150 feet in length, a few minutes after the mixture had been made, the general diffusion of chlorine was sufficiently evident; in half an hour it was often almost impossible to enter, and frequently on looking along the gallery the yellow tint of the atmosphere could easily be perceived. Up to the fifth day the colour of the chlorine could generally be observed in the building; after the sixth day the pans were removed, though sometimes with difficulty, and the gallery thus fumigated had its windows and doors thrown open. The charge contained in each pan was estimated to yield about 5½ cubic feet of chlorine gas; in fumigating a space of 2,000,000 cubic feet, about 700 lbs. of common salt and the same of binoxide of manganese were employed; and it will appear by a slight calculation, that about 1710 cubic feet of chlorine were employed to disinfect this space. In common cases, Mr. Faraday conceives that about one-half to one-fourth of this quantity of chlorine would be sufficient.

When any cause is continually recurring, and in some cases almost imperceptibly so, the chloride of lime or soda, and especially of the former, has been within a few years successfully employed by M. Labarraque; the exact nature of these compounds is still under discussion, but the chloride of lime is a substance well known and extensively employed under the name of bleaching-powder.

We shall relate a few experiments performed by M. Gaultier de Claubry, illustrative of the mode in which these substances produce their effects. A solution of chloride of lime exposed to the air for about two months, ceased to act upon litmus, contained no chlorine, but a precipitate was formed in it which consisted entirely of carbonate of lime, without any admixture of chlorine; it was therefore evident that the carbonic acid of the atmosphere had decomposed the chloride of lime, evolved the chlorine, and precipitated the lime. That this was the case was proved by passing atmospheric air through a solution of potash, before it was made to traverse one of chloride of lime; in this case the

potash separated the carbonic acid, so that no chlorine was evolved from the solution of chloride of lime, nor was any precipitate formed in it; in fact no change whatever occurred. That it was the carbonic acid which produced this effect, was further proved by passing a current of this gas into a solution of chloride of lime; by this it lost its bleaching power, the whole of the chlorine was expelled, and all the lime converted into carbonate.

In order to show the manner in which these compounds of chlorine and lime, and of chlorine and soda, act on putrid miasmata floating in the air, some further experiments were made in the following manner:—Air was passed through blood which had been left to putrefy for eight days; being then passed through a solution of the chloride of lime, carbonate of lime was deposited, and the air was rendered inodorous and completely purified. In a second similar experiment the fetid air was passed through a saturated solution of potash before it arrived at the solution of chloride of lime; the latter had then no effect upon it, and the air retained its insupportable odour; this happened evidently because the carbonic acid, which would otherwise have evolved chlorine to have acted upon the putrid matter, was absorbed by the potash. Another experiment was made with air left for twenty-four hours over putrescent blood; the portion of it which was passed directly through the chloride was perfectly purified, but when previously freed from carbonic acid the chloride had no effect upon it.

These experiments sufficiently prove that the carbonic acid in the air, arising from the various sources of respiration, combustion, and the decomposition of animal and vegetable matter, liberates the chlorine from its combination with lime or soda; and as this action is slow, the chlorine, though scarcely susceptible of affecting the animal economy, readily decomposes putrid miasmata. It is therefore true fumigation by chlorine, only it is less violent than that effected by the rapid evolution of the gas, and it continues for a longer time.

It is to be observed that chloride of lime is used in solution, and is obtained by dissolving one part of bleaching powder in about 100 times its weight of water, and allowing the solution to become clear. This is to be exposed to infected air, or in rooms which have any unpleasant odour, in flat vessels, in order that a sufficient surface may be acted upon. If it should be required, the operation may be quickened by the addition of a little vinegar, or of muriatic acid largely diluted. In some cases, where the disagreeable is extremely strong, and where it would be difficult to expose a solution to slow action, it may be thrown into the place, or the powder may be used, the action of which would be more gradual and effectual. Chloride of soda is prepared only in solution; the process is given in the last edition of the London Pharmacopœia: it is however less easily obtained than the chloride of lime, is more expensive, and not in any respect preferable; the solution is then called liquor sodæ chlorinatæ.

FUNCHAL. [Madeira.]

FUNCTIONS, CALCULUS OF. By the term *function of a quantity* is meant any algebraical expression, or other quantity expressed algebraically or not, which depends for its value upon the first. Thus the circumference of a circle is a function of the radius; the expression $(a^2 - x^2)(b^2 + y^2)$ is a function of a, b, x, and y. For the distinctive names of functions, see Transcendental and Algebraical.

All algebra is, in one sense, a calculus of functions; but the name is peculiarly appropriate, and always given, to that branch of investigation in which the *form* of a function is the thing sought, and not its value in any particular case, nor the conditions under which it may have a particular value. [Equations, Functional.] For instance, 'What is that function of x which, being multiplied by the same function of y, shall give the same function of $x + y$?'—is a question of the calculus of Functions.

Various isolated questions connected with this calculus have been treated, from the time of Newton downwards, particularly by Lagrange, Laplace, Monge, and Euler. But the direct solution of functional equations, or at least the first attempt to form general methods in the case of functions of a single variable, appears to have been made by Mr. Babbage and Sir J. Herschel (1810-1813). To the treatise entitled 'Examples of the Calculus of Differences,' by the latter, the former appended another, containing examples of the solutions of functional equations. This and the article, 'Calculus of Functions,' in the 'Encyclopædia Metropolitana,' are the only formal treatises on the subject, of which we know.

A function of x is denoted by ϕx, ψx, χx, fx, Fx, Φx, &c., &c., the first letter being a symbol of an operation to be performed. Thus, Ffx denotes that when the operation signified by f has been performed upon x, that signified by F is performed upon the result. When the same operation is repeated, the results may be denoted by fx, ffx, $fffx$, &c., which may be abbreviated into fx, f^2x, f^3x, &c. For different points of interest connected with the relations of functional forms, see Periodic; Inverse.

FUNCTIONS, THEORY OF, a name given by Lagrange to a view of the principles of the Differential Calculus, of which we have expressed our opinion in the article Differential Calculus. The works of Lagrange, in which its details are to be found, are 'Théorie des Fonctions Analytiques,' first edition, 1797; second edition, 1813; and 'Leçons sur le Calcul des Fonctions,' of which the first edition is volume 10 of the 'Leçons de l'Ecole Normale (1801), and the second was published in 1806.

Taking Lagrange's intention to have been the proof that algebra, as it existed in his time, was sufficient to demonstrate the principles of the Differential Calculus without the introduction of limits, we have only to remark that the end is completely attained. [Differential Calculus.] It is plain to any one acquainted with that calculus, that a demonstration of Taylor's Theorem being once attained, all the rest follows. We now proceed to look at the proof of this theorem given by Lagrange, with reference to absolut correctness or incorrectness.

Lagrange first attempts to prove that every function ϕx has this property, that $\phi(x + h)$ can be expanded in a series of the form

$$\phi(x + h) = \phi x + Ah + Bh^2 + Ch^3 + \ldots\ldots$$

He says, firstly, that no negative powers of h can enter the expansion, for if such were the case $\phi(x + 0)$, instead of being ϕx, would be infinite. This is true as to any finite number of negative powers of h, but does not exclude an infinite series of negative powers. For instance,

$$\frac{1}{x + h} = \frac{1}{h} - \frac{x}{h^2} + \frac{x^2}{h^3}$$

when $h = 0$, *all* the terms become infinite, but the first side of the equation is not infinite. Secondly, he assumes that there cannot be fractional powers of h, for if such were the case, there must be fractional powers in the original function ϕx, and if ϕx had m different values, and if $Kh^{\frac{p}{n}}$ were one of the terms of the development, the n values of this latter, combined with the m values of ϕx, would give mn different values to $\phi(x + h)$, instead of m. In answer to this it may be asked how is it known, *à priori*, that there must be a series of powers of h, *every* value of which is an expansion of $\phi(x + h)$? May it not possibly be true that there is an expression of the form

$$\phi(x + h) = \phi x + Ah^a + Bh^b$$

which is true under certain conditions, determining which of the values of the several terms are to be taken? Thirdly, he assumes that (having thus obtained a series, in which only whole powers of h are found) the supposition $h = 0$ must reduce it to its first term; an assumption which can only be admitted of such a series as $M + Ah + Bh^2 + \ldots$ when it can be made convergent by giving sufficiently small values to h.

Having once proved or assumed that $\phi(x + h)$ can be expanded in a series of the form $\phi x + Ah + Bh^2 + \ldots$ the proof of Taylor's Theorem, given by Lagrange, does not differ from the common one. He calls A the derived function of ϕx, and denotes it by $\phi' x$: generally, if changing x into $x + h$ change P into $P + P'h + \ldots$, P' is the derived function of P. The derived function of $\phi' x$, denoted by $\phi'' x$, is called the second derived function of ϕx, and so on. By changing x into $x + k$, $\phi(x + h)$, or $\phi x + Ah + Bh^2 + \ldots$, becomes

$$(\phi x + \phi' x . k + \ldots) + (A + A'k + \ldots) h + (B + B'k + \ldots) h^2 + \ldots\ .$$

and by changing h into $h + k$, $\phi(x + h)$ becomes

Public Library $+ k) + B(h + k)^2 + \ldots$

These must be the same, since both represent $\phi(x+h+k)$: and by equating the terms which contain the first powers of k, we find

$$\phi' x + A' h + B' h^2 + \ldots = A + 2Bh + \ldots.$$

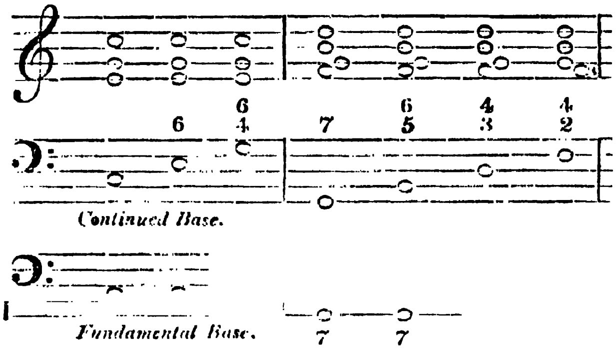
whence $A = \phi' x$, $2B = A' = \phi'' x$, and so on. The reader will recognise in this process the proof frequently given by means of the preliminary lemma, that if

$$u = \phi(x+h), \quad \text{then } \frac{du}{dx} = \frac{du}{dh}.$$

The works of Lagrange on this subject, though defective in their fundamental positions, except upon the explanation given in DIFFERENTIAL CALCULUS, yet abound in new and useful details, given with all the elegance for which his writings are distinguished: and the student will find them well worth his attention.

FUNDAMENTAL BASE, in music, is the lowest note of the Perfect Chord, or Triad, as the Germans call it, and of the chord of the 7th: hence it is the root of all real chords:—for chords not derived from either the perfect chord or that of the 7th, are considered as suspensions or retardations; or, to speak in unaffected language, the discordant notes of which they are composed are simply appogiaturas. [CHORD.]

The following will show the two *Fundamental Chords*, and their inversions, with the continued [CONTINUED], or ordinary base, and the *Fundamental Base*.



This term is not the best that might have been chosen: the same meaning is much better conveyed by the word *radical*, introduced, we believe, by Dr. Callcott. The *system* of the Fundamental Base, founded on harmonics, and a continual addition of thirds to the triad, is indebted for its origin to Rameau, the celebrated French composer [RAMEAU], and was once almost universally received. D'Alembert wrote a book to explain and eulogise it, and Marpurg, a most distinguished theorist, adopted it in his *Handbuch bey dem Generalbasse*. But though it may be rendered in some degree serviceable in the analysis of chords, it is in more than one respect erroneous, and the rules drawn from it by its author would cruelly fetter genius, were they allowed to exert any influence on the composition of music. Rameau's once vaunted system is now therefore entirely laid aside, even in the country that gave it birth.

FUNDS and FUNDING SYSTEM. [NATIONAL DEBT.]

FUNDY, BAY OF, is the most extensive gulf on the eastern coast of North America, between Cape Florida and the mouth of the St. Laurence river. It separates Nova Scotia from New Brunswick, and lies between 44° and 46° N. lat. and 63° and 67° W. long. Its direction is from east-north-east to west-south-west; its entrance is at the west-south-western extremity.

This entrance is formed by Brier Island, on the side of Nova Scotia and Quoddy Head, on the mainland; a straight line between these two points passes through the island of Grand Manan, which lies about 8 or 9 miles from Quoddy Point, and 35 miles from Brier Island. In this part the bay is about 50 miles wide; but it narrows by degrees to about 30 miles and less, after which it again attains a width of between 30 and 35 miles, which breadth it preserves for the greatest part of its extent, the shores of Nova Scotia and New Brunswick running nearly parallel. Towards its inner extremity it is divided, by a bold headland terminating with Cape Chignecto, into two smaller bays, of which one extends due east, and is called the Bay of Minas; the other, preserving the east-north-eastern direction, is named Chignecto Bay. The whole length of the Bay of Fundy is about 180 miles.

Both shores of the large bay are rocky and bold, but especially so on the side of Nova Scotia, where a chain of hills, probably not less than 500 feet above the sea, rises at a short distance from the coast. The entrances, both of the Bay of Minas and of Chignecto, are likewise rocky; but in the interior the shores are low, sandy, and flat.

The navigation of the bay is both difficult and dangerous, on account of the great strength of the tide and the prevailing fogs. The tide rises to a great height, sometimes seventy feet, and flows with great rapidity, running at the entrance about three miles an hour, increasing as it advances to more than seven, and at length rushing with great impetuosity into the bays of Minas and Chignecto. Fogs cover the bay when the wind blows from the east and south-east, or from the Atlantic; and during their prevalence many vessels are cast on the rocky shores by the violence of the tides.

The Bay of Minas has been united with Halifax Harbour, which is situated on the Atlantic side of Nova Scotia, by a canal fifty-four miles long, and capable of receiving vessels which draw only eight feet of water. It is called the Shubenacadie Canal. Another canal was projected a few years ago, which was to connect the most northern corner of Chignecto Bay, called Cumberland Basin, with Northumberland Strait. This strait separates Prince Edward Island from New Brunswick and Nova Scotia, and one of its bays, called Bay Verte, is separated from Cumberland Basin only by an isthmus eleven miles across. The advantages of such a canal are obvious; but we are not aware that it has been executed. (M'Gregor's *British America*; Bouchette's *British Dominions in North America*.)

FÜNEN, or FUHNEN (in Danish Fyen), a 'stift' or province of Denmark, consisting of the islands of Fünen, Langeland, Taasing, and several islets. It has an area of 1286 square miles, and a population of about 160,000 (in 1801, 121,378), and is divided into the two circles or bailiwicks of Odense and Svendborg, which contain 3 earldoms, 4 baronies, 9 towns, and 201 parishes. It is a bishop's see, and is subdivided into 15 minor circles or herreder, in which there are 180 seignorial estates. The soil is a layer of rich loam on a substratum of clay or sand: it has some hills, but no streams deserving the name of rivers. The produce is grain, vegetables, flax, &c., and great number of horses and cattle are reared. The whole of the town are in the island of Fünen, with the exception of Rudkiöbing, in the island of Langeland, a place of much trade, with about 250 houses and 1500 inhabitants

FÜNEN, or FYEN, an island situated in the Baltic, between the eastern coast of the duchy of Schleswig and of Jütland, and the western shores of the island of Seeland, from which parts it is separated by the Great and Little Belts, between 55° 2′ and 55° 47′ N. lat. and 9° 46′ and 10° 51′ E. long. Its area is about 1176 square miles, and its population, which was 91,333 in 1769, is at present about 144,000. The surface is a level, varied by hills in the southern districts, but they never rise above 500 feet. The north-east of the island is deeply indented with bays of the Kattegat, particularly the 'Odense fiord,' and is more uniform and less wooded than the south. The soil is in general rich and productive. Fünen abounds in small streams, here called Aas, and lakes: the most considerable lakes are those of Arreskov, Brendegards, and Juulbye. The canal of Odense, which commences at Odense and terminates at Skibhusene, on the Odense fiord, is about two miles and a half in length, ten feet deep, and fifty feet in breadth at the surface. The climate is damp and variable, but milder than that of Seeland. About 610,000 acres are arable and meadow land. The principal crops are barley, oats, and buckwheat, and the quantity of grain annually exported amounts to about 100,000 quarters. Much flax and hemp are raised, and the growth of hops exceeds 2300 cwts. yearly. With the exception of potatoes, the cultivation of vegetables is limited, but the orchards are numerous, and an inferior kind of cider is made. About 78,600 acres are occupied by woods and forests, which, with the peat-moors, supply fuel. The Fünen breed of horses is much sought after, and the stock of the island, including that of Langeland, is upwards of 42,000: that of horned cattle is about

81,000, and of sheep, mostly of improved breeds, 90,000. It is estimated that upwards of 20,000 swine are fed. Honey and wax are regular articles of exportation. There is no game besides hares and rabbits, but a great quantity of wild-fowl and poultry, especially geese. The fisheries are productive. The only minerals are freestone, chalk, and limestone. There are no manufacturing establishments; the peasantry however are industrious operatives under their own roofs, and make their own woollen and linen yarn, stockings, and clothing. The townspeople prepare leather and manufacture brandy. Gloves are made at Odense, and woollens and linens are printed at Svendborg.

The exports of Fünen consist of corn, pease, brandy, apples, horses, oxen, butter, salted meat, tallow, hides, hops, linen, honey, and wax. Odense, which by its canal has a direct access to the sea, is the great trading mart of the island. There is a good road from Middelfahrt to this town; but the roads are in general very bad. The people of Fünen are, like their neighbours, somewhat indolent and shy of work, as well as phlegmatic: they are however an honest, sound-hearted race. Their religion is the Lutheran.

The principal towns in Fünen are Odense, the capital and episcopal residence, pleasantly situated, and reputed to be the most antient town in Denmark; in 55° 25′ N. lat., and 10° 22′ E. long. It has about 1100 houses, and 8600 inhabitants. Here are a royal palace, built by Frederick IV., a townhall, four churches (of which that of St. Canute is a noble Gothic pile, erected eight centuries ago, and containing the mausolea of St. Canute, Erichslaf, John, and Christian III., kings of Denmark and Norway), a chapter seminary, gymnasium, theatre, two public libraries, hospital, house of correction, &c. Assens, on the western coast, at the entrance into the Little Belt, another old town, has an indifferent harbour, a townhall, one church, about 350 houses, and 2330 inhabitants. Bogense, on the north coast, the smallest town in the province, has one church, about 250 houses, and 1000 inhabitants. Kiertеminde, beautifully situated on a bight of the Great Belt, which is crossed by a large wooden bridge, has one church, a school, two hospitals, about 260 houses, and 1500 inhabitants. Middelfahrt, on the Little Belt, has a townhall, church, hospital, school, about 240 houses, and 1300 inhabitants, and a ferry about a mile across to Snoghoi on the Jutland coast. Svendborg, the chief town of the bailiwick of this name, is at the south-eastern extremity of Fünen, on an arm of the Baltic which separates that island from Taasing; in 55° 5′ N. lat. and 10° 38′ E. long. It has two churches, a townhall, three schools, about 350 houses, and 3400 inhabitants, and exports much grain, &c. Nyeborg, a fortified town on the eastern coast, contains the remains of the palace in which the kings of Denmark held their courts and national diets, with a church, townhall, several schools, a hospital and an infirmary, about 300 houses, and 2900 inhabitants. The Swedes were totally defeated by the Danes under its walls in 1659. And lastly, Faaborg, in the south-west, is a small town with about 260 houses and 1500 inhabitants, a handsome church, &c., and a good harbour on an arm of the Little Belt, protected at its entrance by the three islands of Lyöe, Avernaröe, and Biörnöe.

FUNERAL, the performance of the rites of sepulture or burial; generally supposed to be derived from the Latin *funis*, a torch, because, at least in the Roman times, funerals were sometimes performed by torch-light. Others derive the word from *phónos* (φόνος), 'slaughter,' as designating death.

The Egyptians are among the earliest people of whose religious ceremonies we have authentic accounts, more particularly in what related to their dead. Upon this occasion the parents and friends of the deceased put on mourning habits, and abstained from gaiety and entertainments. The mourning lasted from forty to seventy days, during which time the body was embalmed; and, when the process was completed, placed in a sort of chest, which was afterwards preserved either in their houses or in the sepulchres of their ancestors. Before the dead were allowed to be deposited in a tomb, they underwent a solemn judgment, upon an unfavourable issue of which they were deprived of the rite of burial.

The mourning customs of the antient Jews can only be collected from an examination of the Prophets and other parts of Scripture. That they sometimes burnt the body is clear, but burial in a sepulchre was the more general fashion. The circumstances attending the burial of the dead among the modern Jews are minutely detailed by D. Levi, in his 'Succinct Account' of their Rites and Ceremonies, p. 162-170.

The funeral rites of the Greeks and Romans have been collected with great research by Guichard in his 'Funérailles, et diverses Manières d'ensevelir des Romains, Grecs, et autres Nations,' 4to., Lyon, 1581; by Meursius, in his treatise 'De Funere Græcorum et Romanorum,' 12mo., Hag. Com. 1604; by Gutherius, 'De Jure Manium, seu de Ritu, More, et Legibus prisci Funeris,' 12mo., Par., 1613, reprinted in 4to., 1615, and again in 8vo., Lips., 1671; and by Kirchman, 'De Funeribus Romanorum Libri IV.,' 12mo., Hamb., 1605, and Lugd. Bat., 1672. See also the 'Ceremonies Funèbres de toutes Nations,' par le Sr. Maret, 12mo., Par., 1677.

In the religious creed both of the Greeks and Romans, sepulture was peculiarly an act of piety toward the dead, without which it was supposed the departed spirit could not reach a place of rest. To be deprived of the proper rites was considered the greatest misfortune. The funeral rites of the Greeks and Romans were in many respects similar, and among both nations the practice prevailed of burning the dead and collecting the ashes in urns. In the case of public funerals, according to Servius's Commentary on Virgil, the deceased was kept seven or eight days, and every day washed with hot water, or sometimes with oil, that in case he were only in a slumber he might be waked; and at stated intervals his friends meeting made a shout with the same view: this was called *conclamatio*. On the seventh day, if no signs of life appeared, he was dressed and placed on a couch in the vestibule, with the feet outwards, as if about to take his departure. In the course of these seven days, an altar was raised near the bed-side, called *acerra*, on which the friends offered incense. The scene here described is frequently represented in antient bas-reliefs. (See the *Townley Marbles*, vol. ii., pp. 167, 228, &c.) On the seventh day the last 'conclamatio' ended, when the couch and body were carried to the *rostra*, where the nearest of kin pronounced the funeral oration, and afterwards to the funeral pile. The body having been consumed, the ashes were gathered, inclosed in an urn, and finally laid in the sepulchre or tomb. An apotheosis or canonization was frequently part of the funeral ceremony of the emperor.

The Magi among the Medes and Persians neither burned nor buried their dead, but left them to birds of prey or dogs. (Herod. i., 140; Strabo, 735, 746.) Chardin, in his 'Travels,' vol. ii., p. 186, has given a full description of a modern Persian cemetery; and Niebuhr describes the Parsees near Bombay as still exposing their dead after the antient fashion mentioned in Herodotus. (Niebuhr, *Reisebeschreibung*, ii., 50.) Tacitus, in his treatise 'De Moribus Germanorum,' (c. 27) notices the simplicity of the funerals among the antient Germans. Like the Romans, they burned their dead. The things which a German valued most were his arms and his horse: these were added to the funeral pile, with a persuasion that the deceased would have the same pursuits in his new state of existence.

In the tomb of Childeric, king of the Franks, his spear, his sword, with his other warlike weapons, and even his horse's head, were found. (See Montfaucon, *Monumens de la Monarchie Françoise*, tom. i., p. 10.)

Lafitau, Charlevoix, and other travellers describe the same notions of a future state and the same funeral ceremonies as prevalent among the savages of America. Dr. Robertson (*Hist. of Amer.*, vol. ii., b. 4) says, as they imagine that departed spirits begin their career anew in the world whither they are gone, they bury together with the bodies of the dead, their bow, their arrows, and other weapons used in hunting or war; they deposit in their tomb the skins or stuffs of which they make garments, Indian corn, venison, domestic utensils, and whatever is reckoned among the necessaries in their simple mode of life.

For the funeral rites of the early Christians, the reader may consult Gretser 'De Funere Christiano,' 4to., Ingolst., 1611; and he may learn the customs of a later period from Durand, who wrote his 'Rationale Divinorum Officiorum' in the twelfth century.

Brand, in his 'Popular Antiquities,' vol. ii., p. 139 to 212, has much upon the English ceremonials, beginning with

'Watching with the Dead,' called in the north of England the Lake-Wake; he then proceeds with 'Laying out or streaking the Body;' setting salt or candles upon it; funeral entertainments; sin-eaters; mortuaries; following the corpse to the grave, and carrying evergreens, torches and lights at funerals; black used in mourning; the pall and under-bearers; doles and donations to the poor at funerals church-yards; garlands in churches; and strewing flowers upon graves.

Strutt's 'Manners and Customs,' and Gough's 'Sepulchral Monuments of Great Britain,' are other works to which the reader may refer for the antient funeral rites of England.

Funeral entertainments, called silicernia and *cœnæ ferales* by the Romans, are of very antient date. They are still kept up in the north of England, and are there called arvals or arvils. Among some extracts from the Berkeley Manuscripts, we read that 'From the death of Maurice, the fourth Lord Berkeley, which happened June 8th, 1368 until his interment, the reeve of his manor of Hinton spent three quarters and seven bushels of beans in fatting one hundred geese towards his funeral, and divers other reeves of manors the like, in geese, ducks, and other poultry. Walsingham, speaking of those who attended Richard II.'s funeral at Langley, in 1399, says, 'Nec erat qui eos invitaret ad prandium post laborem.' (*Hist.*, p. 405.) Shakspeare has a well-known allusion to these feasts in Hamlet act i., sc. 2:

> 'The funeral baked meats
> Did coldly furnish forth the marriage tables.'

FUNERAL ORATIONS, discourses at funerals, are of great antiquity. The second book of Thucydides (c. 35 &c.) contains the laboured harangue delivered by Pericles at the solemn funeral ceremony instituted in honour of those Athenians who fell at the beginning of the Peloponnesian war; and other similar orations are extant in Greek Augustus, at the early age of twelve, performed this office for his grandmother, and afterwards, when emperor, for the young Marcellus. Tacitus tells us that Nero pronounced a funeral oration over his wife Poppæa. Funeral orations were equally common over Christian martyrs; and Durand. in his 'Rationale,' already referred to, says, 'Ceterum priusquam corpus humo injecta contegatur, defunctus oratione funebri laudabatur.' Fuller, in his 'Appeal of injured Innocence,' (part iii., p. 75,) and Misson, in his 'Travels in England,' show the continuance of this practice to the close of the seventeenth century. Gay alludes to it in his 'Dirge:'

> 'Twenty good shillings in a rag I laid.
> Be *ten* the parson's for his sermon paid.'

The practice of delivering what may be properly called funeral orations, that is, addresses over the grave or at the interment of the dead by laymen, is common among the French, and is not unfrequent on great occasions among the people of the United States.

FUNERAL SHOWS or GAMES frequently followed public funerals among the Greeks and Romans. An early example of this occurs in the funeral games celebrated by Achilles in honour of Patroclus. (Homer, *Iliad.*) As the dead were supposed to be delighted with blood, various animals, especially such as the deceased had been fond of, were slaughtered at the pile, and thrown into it: and, in still ruder times, captives or slaves. Among the Romans, gladiators, called *bustuarii*, were made to fight. Junius Brutus exhibited gladiators at his father's funeral; and the 'Adelphi' of Terence, at a later period, was produced for the first time at the funeral of Lucius Æmilius Paulus.

FÜNFKIRCHEN (in Hungarian *Pecs*, and in the national records Quinque Ecclesiæ), an old town in the county of Baranya in Hungary, and the seat of provincial administration, consists of a single street built at the foot of the lofty Mount Metshek, and at the edge of a rich and extensive valley, in 46° 5′ N. lat. and 18° 16′ E. long. Soyman, the Turkish sultan, who resided here, was wont to call it 'the Paradise of the Earth.' The number of houses is about 2000, and the population is about 11,500. This town contains several handsome buildings, an episcopal palace, an ecclesiastical seminary, a gymnasium, a cathedral standing on high ground (the site of a Roman castellum), and said to be the oldest in Hungary, a fine, massively-built church of the Jesuits, several churches, some of which were formerly Turkish mosques, a public library and cabinet of coins, two monasteries, two hospitals, &c. In the vicinity are mines of excellent coal, and some alum and vitriol works, as well as extensive vineyards. Large quantities of grain and tobacco are grown about Fünfkirchen, and much rape-seed is raised for making oil. The trade of the town is chiefly in the produce of the country, and in leather, which is manufactured here, and in great request throughout Hungary. There are mineral springs and baths. Some have supposed that the Roman colony Serbinum was planted on this spot. It was in the hands of the Turks from 1543 to 1686, and is the place of assembly for the provincial states.

FUNGI. Under this name botanists comprehend not only the various races of mushrooms, toadstools, and similar productions, but a large number of microscopic plants forming the appearances called mouldiness, mildew, smut, rust, brand, dry-rot, &c. Notice has been occasionally taken of these plants under their respective heads; in this place some general account will be given of them as a large natural order.

Nothing can well be more different than the extremes of development of Fungi, if the highest and the lowest forms are contrasted; as for example, the large fleshy Boleti, which inhabit the trunks of trees, and the microscopic mould-plants, composed of threads much too delicate to be distinguished by the naked eye. Nevertheless, it turns out upon inquiry that the latter is only a simple form of the former, or, in other words, that a Boletus is merely an enormous aggregation of the vegetable tissue constituting a Mucor, developed upon the same plan, subject to the same influences, possessing a similar chemical character, and propagating by means which are altogether analogous.

Viewed with reference to their whole extent, the plants of this order may be described as cellular or filamentous bodies, having a concentric mode of development, often when full grown almost amorphous, absorbing oxygen and exhaling carbonic acid, and propagating either by means of microscopic granules, which are lodged in particular receptacles, or by a dissolution of their whole tissue.

That they are cellular or filamentous may be easily ascertained by examining them with even an indifferent microscope; perhaps they might be even simply described as cellular, for their filamentous tissue seems nothing but cells drawn out. Sometimes, as in the genus Uredo, they consist of spheroidal cells, having little connection with each other, each cell containing propagating matter, and all separating from each other in the form of a fine powder when ripe: the smut in corn is of this nature; or, as in Cylindrosporium, the cells are truncated cylinders not adhering, so far as we can see, and separating in like manner when ripe. In plants of a more advanced organization, as the genus Monilia, the constituent cells are connected in series, which preserve their spherical form, and also contain their own reproductive matter; while in such plants as Aspergillus the cells partly combine into threads forming a stem, and partly preserve their spheroidal form for the fructification (*fig.* 24). From adhering in simple series, the structure of Fungi advances to a combination of such series into strata, whence result the various kinds of dry-rot, thick leathery expansions developing amidst decaying timber; a more complicated form is thence produced in the form of puff-balls, truffles, sclerotiums, and the like, in which a figure approaching that of a sphere is the result, the reproductive cells being indiscriminately confused in the interior of such plants; and finally, the organization is so much complicated, that, independently of a mere aggregation of tissue, we find envelopes of various kinds for the protection of the propagating mass, as in Agaricus and Geastrum, and special receptacles for the propagating matter, as in Boletus and numerous others.

It is probable however that in all Fungi, and certain that in most of them, the first development of the plant consists in what we here call a filamentous matter, which radiates from the centre formed by the spore (or seed), and that all the cellular spheroidal appearances are subsequently developed, more especially with a view to the dispersion of the species. We purposely say dispersion, not multiplication; for it is certain that the filamentous matter is quite as capable of multiplying a fungus as the cellular or spheroidal. This is partly proved by the common mushroom (Agaricus campestris), whose filamentous matter is commonly sold, under the name of spawn, for the artificial multiplication of that species in gardens; and more completely by some recent experiments of M. Audouin, who found that the

Botrytis Bassiana would inoculate caterpillars and other larvæ as readily by minute portions of its spawn as by its spores or seedlike spheroidal particles. Although, however, there seems so much reason to ascribe the presence of a filamentous spawn to all Fungi, yet it is seldom seen by the ordinary observer; for it develops out of sight, under ground, in the midst of the decaying matter on which Fungi so often appear, or through the very substance of living matter; and it is only the aggregation of spheroidal matter which we see. It would appear that for the growth of the former darkness is necessary, and that the latter is stimulated into existence by the action of a feeble quantity of light. To apply to these parts familiar and equivalent names, we should say that the stalk or stem radiates in dark damp situations, where it is buried from sight, and that the spheroidal part or fructification alone is able to develop beneath the light of day. The spawn of the mushroom is its stem, the mushroom itself is the fructification of the plant.

It is generally believed that spiral cells are unknown in Fungi; Corda however, in his recent microscopical work on these plants (*Icones Fungorum hucusque cognitorum*, Prag. 1837), figures them in the genus Trichia, calling them elaters, and thus assigning them a nature analogous to that of the organs known by the same name in Jungermanniaceæ and Marchantiaceæ.

The concentric growth of the filamentous stem or spawn of Fungi may generally be witnessed in damp cellars, when they begin to grow without impediment upon the walls or decaying wood. Nothing is more common in such situations than to see a beautiful white flocculent matter, which a breath almost will dissipate, spreading from a centre nearly equally in all directions; such appearances, formerly called byssi, have been ascertained to be the spawn of various kinds of Fungi, the fructification of which is probably never developed. Evidence of the existence of a similar mode of growth may be found when the spawn itself is not visible, as in fields where Fungi so often spring up in circles or rings; this arises from their stem having originally spread circularly from its point of origin, and thrown up its fructification at the circumference of the circle so formed.

Unlike other plants, Fungi, instead of purifying the air by robbing it of its carbonic acid and restoring the oxygen, vitiate it by exhaling carbonic acid and absorbing oxygen. This has been proved experimentally by Dr. Marcet of Geneva; and (Lindley, *Intr. Bot.*, ed. 2, p. 324) will probably explain the cause of Fungi being so universally destitute of green colouring matter, which we know results from the decomposition of carbonic acid. It affords, no doubt, an additional argument to those who believe that Fungi are an intermediate kingdom between plants and animals; an idea which, like that of believing them to be 'atoms of vegetable matter combined by the expiring forces of nature,' we do not think it necessary seriously to discuss. That they are not equivocally generated is sufficiently proved by each species having its own particular kind of seed or spore: a provision that would be perfectly unnecessary if the species sprang up out of decaying matter by the mere action of particular combinations of external forces. To assert the existence of fortuitous creations in this class of plants is contrary not only to analogy but to the plainest evidence. The experimental observer may indeed discover that Fungi will regularly develop in one kind of chemical mixture and not in another: Dutrochet, for example, found that, if he acidulated a weak solution of white of egg, different species of Monilia rapidly formed upon it; while, if he rendered such a solution slightly alkaline, the genus Botrytis made its appearance, and that the solution in its simple state, neither alkalescent nor acidulated, produced no Fungi—a remarkable circumstance enough. But it would be too much to infer from such an experiment, 'that invisible germs of a filamentous plant may be created by the chemical action of an acid or an alkali on organic matter dissolved in water, and that they develop by virtue of the vital action which would be the necessary attribute of this *chemico-organic molecular compound*:' on the contrary, the experiment only showed that the seeds of Fungi, like those of other plants, require special soils in which to grow; that Botrytis will not grow in acid mucilage, nor Monilia in alkaline, nor either in mucilage in a neuter state. This is only what happens in plants of a more highly organized nature. Who ever saw the horned poppy of the sea-shore growing spontaneously in an inland field, the marsh marigold on a dry heath, or the reindeer lichen of Lapland on a heath in Italy? Let any one take a few different kinds of seeds and commit them all to the ground in the same place; some will spring up and flourish, others will just appear above ground and then perish, others will make an attempt to germinate. This, an every-day event, is a sufficient explanation of the fact elicited by M. Dutrochet's experiment. Every kind of seed has something specific in its nature, in consequence of which it requires particular kinds of soil, and some special combination of heat, light and moisture, to be roused into a state of vegetation. As to the presence of the seeds of the Botrytis and Monilia in the vessels in which M. Dutrochet's experiments were conducted, it is perfectly easy to conceive that the seeds of such common plants exist everywhere suspended in the air or adhering to the cleanest vessels; they are so numerous as to baffle all powers of calculation; they are so minute as only to become visible when aggregated in masses of many thousands, and so generally dispersed that it is difficult to conceive a place in which they may not be reasonably supposed to exist. The very general existence of dry-rot is no weak evidence of this; but upon that subject we have already made what observations we have thought necessary. [Dry-Rot.]

Fungi are among the most numerous of all plants in regard to genera and species, so abundant indeed that no one has as yet attempted to form an estimate of their numbers. Fries somewhere asserts that he had discovered above 2000 within the compass of a square furlong in Sweden; even the European species of microscopic Fungi are but little known, if we are to judge from the numerous new kinds introduced into Corda's recent work; and as for those which inhabit the tropics, our knowledge of them amounts to little or nothing. It is generally asserted that they are uncommon in tropical countries, but it is doubtful whether this is true, and at all events it appears from the evidence of a recent traveller in that island that they are extremely abundant in Java.

They usually prefer damp, dark, unventilated places, such as cellars, vaults, the parts beneath decaying bark, the hollows of trees, the denser parts of woods and forests, or any decaying matter placed in a damp and shaded situation; and are most especially averse to dryness and bright light. Even when they appear upon the live leaves of trees, the stems of corn, or in similar situations, it is either at the damp and wet season of the year, late in the autumn, or in damp and shaded places; and M. Audouin has shown experimentally that when live insects are attacked by them it is only when they are confined in damp unventilated places. (See *Comptes rendus*, 2nd half-year, 1837.) In stations favourable to their multiplication they often commit extensive ravages, attacking and destroying timber, and producing decay in all kinds of vegetable matter of a soft and succulent nature; nor is it to dead matter that their ravages are confined. They sometimes fix themselves upon live insects, producing great havoc among the silkworms in the manufactories of Italy, and are probably the cause of a more extensive destruction of such animals than we at present have any idea of. Under the name of mildew and blight they commit excessive damage among living plants, as the farmer and orchardist know too well to their cost.

The systematical arrangement of these plants has long exercised the ingenuity of botanists, who have contrived various schemes of classifying them according to what are believed to be their natural relations. The most celebrated of them is the mycological system of Fries. We cannot enter at any length into the details of this arrangement; but, as some difficulty attends the study of it, a short explanation of its fundamental principles may be useful. We shall therefore give a brief explanation of the leading features of this author's arrangement.

Fries in the first place divides the whole order into four Cohorts, distinguished by the following characters:—

Cohort I. Hymenomycetes. A Hymenium present; that is, the fungus opened out into a fructifying membrane, in which the spores (seeds) are placed, usually in the inside of asci (transparent simple cases). The texture wholly filamentous.

Cohort II. Pyrenomycetes. A Perithecium present; that is, the fungus closed up: then perforated by a hole or irregular laceration, and enclosing a distinct kernel holding asci. Texture obscurely cellular; that of the stroma (receptacle) somewhat filamentous.

Cohort III. Gasteromycetes. A Peridium present; that is, the fungus at first closed up and containing loose spores, having no asci. The texture cellular.

Cohort IV. Coniomycetes. Spores naked; that is, the fungus in its elementary state, eventually having the spores quite naked, although they may have been covered at first. The texture between filamentous and cellular; and the thallus often apparently absent.

He then subdivides these cohorts each into four Orders, as follows:—

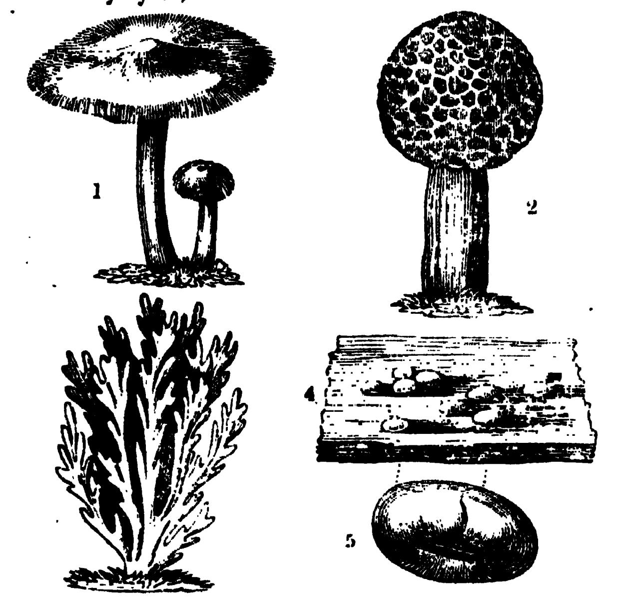
Cohort I.—Hymenomycetes.

Order 1. *Pileati*. The Hymenium on the under side and having asci (*fig*. 1, Agaricus).

Order 2. *Elvellacei*. The Hymenium on the upper side, and having asci (*fig*. 2, Morchella).

Order 3. *Clavati*. The Hymenium on both sides and having asci (*fig*. 3, Clavaria).

Order 4. *Tremellini*. Amorphous. The Hymenium confounded with the receptacle. Asci none. Membranous or gelatinous, with a filamentous texture (*figs*. 4, 5, Dacrymyces).



Hymenomycetous Fungi.
1. Agaricusodorus, reduced in size; 2, Morchella esculenta, reduced in size; 3, Clavaria cinerea, reduced in size; 4, Dacrymyces stillatus, growing in wood, natural size; 5, the same, magnified.

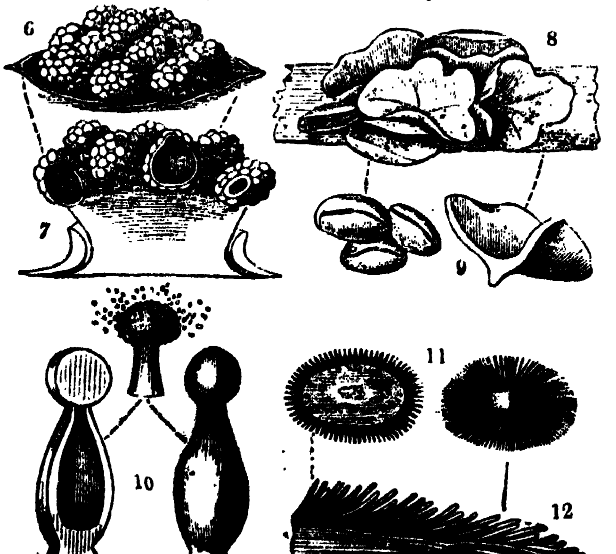
Cohort II.—Pyrenomycetes.

Order 1. *Sphæriacei*. The kernel filled with asci, and deliquescent (*figs*. 6, 7, Cucurbitaria).

Order 2. *Phacidiacei*. The kernel filled with asci, and dry (*figs*. 8, 9, Cenangium).

Order 3. *Cytisporei*. The kernel filled with naked spore-cases, and disintegrating (*fig*. 10, Sphæronema).

Order 4. *Xylomacei*. The kernel filled with naked spore-cases, and dry (*figs*. 11, 12, Actinothyrium).



Pyrenomycetous Fungi.
6, Cucurbitaria cinnabarina, magnified; 7, a section of the same; 8 and 9, Cenangium ferruginosum, magnified; 10, Sphæronema subulatum, magnified; 11, 12, Actinothyrium graminis, magnified.

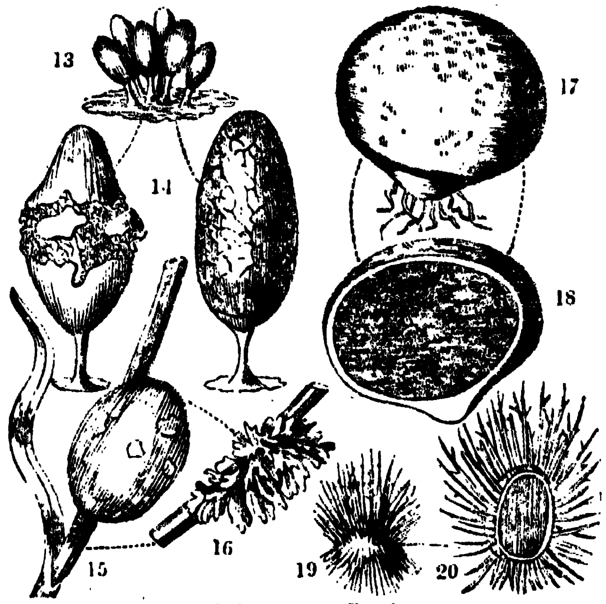
Cohort III.—Gasteromycetes.

Order 1. *Angiogastres*. Spore-cases immersed in a receptacle distinct from the peridium.

Order 2. *Trichospermi*. Spore-cases naked, among filaments distinct from the peridium (*figs*. 17, 18, Scleroderma; *fig*. 13, 14, Arcyria).

Order 3. *Trichodermacei*. Spore-cases naked, covered by filaments constituting a peridium (*figs*. 15, 16, Spumaria).

Order 4. *Sclerotiacei*. Spore-cases immersed in a receptacle constituting the peridium (*figs*. 19, 20, Chætomium).



Gasteromycetous Fungi.
13 and 14, Arcyria punicea, magnified; 15, 16, Spumaria mucilago, magnified; 17, 18, Scleroderma Cepa, magnified; 19, 20, Chætomium elatum, magnified.

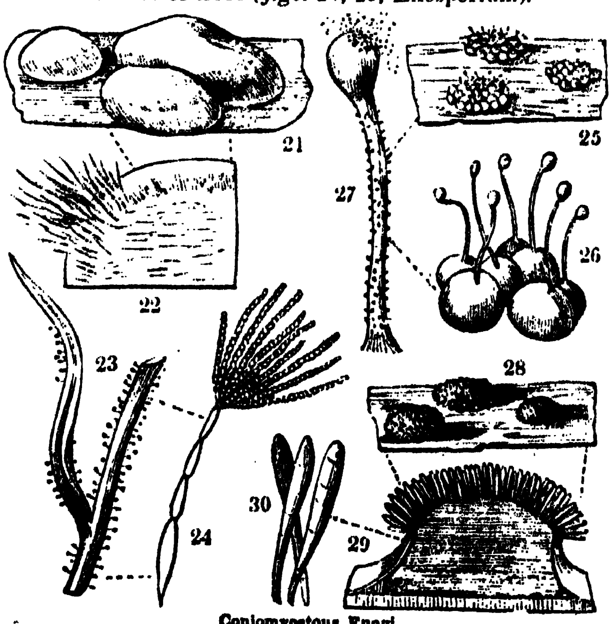
Cohort IV.—Coniomycetes.

Order 1. *Tuberculurini*. Spore-cases plunged in an entangled receptacle, upon a free receptacle (*figs*. 21, 22, Fusarium).

Order 2. *Mucorini*. Spore-cases upon a filamentous receptacle, at first enclosed in a little peridium (*figs*. 25, 26, Stilbum).

Order 3. *Mucedines*. Spore-cases at first concealed by filaments (*figs*. 23, 24, Aspergillus).

Order 4. *Hypodermi*. Spore-cases springing from under the cuticle of trees (*figs*. 28, 29, Exosporium).



Coniomycetous Fungi.
21, 22, Fusarium tremelloides, magnified; 23, a stem of grass covered with Aspergillus penicillatus; 24, the fungus itself, magnified; 25, Stilbum tomentosum, growing on a piece of wood; 26, a highly magnified representation of the same; 27, a spore-case; 28, Exosporium Tiliæ, growing on a leaf; 29, a section of the same magnified; 30, three of the spore-cases, still more magnified.

Those who wish to become acquainted with this subject practically and in its details should consult, not any, but all of the following works:—Fries's *Systema Mycologicum*; Greville's *Cryptogamic Flora*; *Neues System der Pilze*; Corda's *Icones*; Endlichar's *Genera Plantarum*; and the last part of Hooker's *British Flora*. Sowerby's *Fungi* and Bulliard's *Figures* are standard works of reference for figures of these plants.

FU'NGIA. [MADREPHYLLICEA.]

FUNGIC ACID, an acid discovered by Braconnot in the juice of most Fungi. This acid exists partly in a free state in the *periza nigra*, and combined with potash in the *boletus juglandis*; it may be obtained from the juice of either of these vegetables by evaporating it to the consistence of a syrup, and treating it with alcohol. The portion insoluble in alcohol is the fungate of potash, which is to be decomposed by acetate of lead; the fungate of lead is to be decomposed by dilute sulphuric acid, or by hydrosulphuric acid, by which the lead is separated in the state of sulphate or sulphuret, and the fungic acid is left in solution.

This acid, when pure, is colourless, very sour, uncrystallizable, and deliquescent; with lime it forms a difficultly soluble salt, and with potash and soda deliquescent uncrystallizable salts; in these and some other properties it resembles impure malic acid. Some doubt exists as to whether it is a distinct acid.

FUNGIN, the name given by Braconnot to the fleshy substance of mushrooms, purified by digestion in a hot weak solution of alkali: it is whitish, soft, insipid, and but little elastic. It is not acted upon by water, alcohol, æther, dilute sulphuric acid, potash, or soda; it is dissolved by hydrochloric acid when heated, and it decomposes and is decomposed by nitric acid; the results are much gas, oxalic acid, a bitter yellow matter, and two fatty substances, one of which resembles wax, and the other suet; the latter is most abundant. It is a highly nutritious substance, and in many of its properties it strongly resembles lignin.

FUNICULAR CURVE. [CATENARY.]

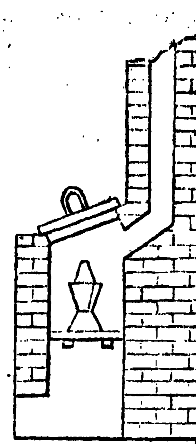
FUNNEL, a hollow conical vessel with a small pipe issuing from its apex; it is an instrument much used in common and domestic life for conveying fluids into vessels of small apertures, and in chemical operations it is used not only for this purpose but for the important one of filtering. [FILTER.] For the mere purpose of the transfer from one vessel to another of such fluids as do not act upon metals, funnels are commonly made of copper, pewter, or tin plate, and this is especially the case when they are employed for conveying powders into bottles. When however they are employed by the chemist with acid, alkaline, or such other solutions as dissolve or corrode the metals, then funnels are made of earthen or stone ware, or of glass. When used for filtration, especially in smaller and nicer operations, those of glass are always to be preferred, and of that kind called *ribbed* funnels, which, on account of the channels that their construction admits of between the filter and the funnel, allow of the more ready passage of the filtered fluid.

FURIES. [EUMENIDES.]

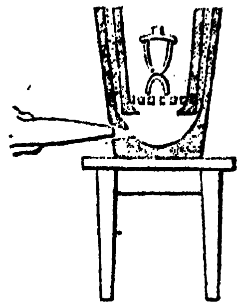
FURLONG. [MEASURES.]

FURNACE. The common grate is the most familiar example of a furnace. It is constructed of iron, and of various forms. The fuel is kept in it only by bars, in order to throw the heat out into the room. Indeed this is its principal use; and although its heat is barely sufficient to melt thin plate silver, yet many chemical operations may be performed in the common stove, and its flat sides or cheeks furnish a lower degree of heat, on which evaporation and digestion may be effected.

For the smaller operations in chemistry a great variety of furnaces have been invented: these it would be quite useless to describe. We shall therefore mention only a few of the more important and generally employed. The annexed figure represents a *wind furnace*: in this a very high temperature is produced without the use of bellows, by means of a powerful draught. The chimney of a wind furnace should be narrow and high; the furnace, represented as connected with and projecting from the chimney, should be of such a height as to allow the operator to look into it; it should be from 12 to 15 inches square, and furnished with moveable bars and a cover; every part exposed to the fire should be constructed of the most refractory bricks. When a very strong heat is required the air should be conveyed by pipes directly from without-door to the ash-pit.



Wind Furnace.



Blast Furnace.

In the figure a crucible is represented as placed in the furnace, and its cover is on.

This furnace is much employed in the reduction of metals, and in the assaying of copper and various other ores. The fuel used is either coke or a mixture of coke and charcoal.

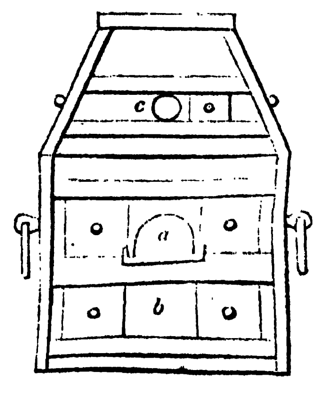
The above cut represents the *blast furnace* which Mr Faraday states in his *Chemical Manipulation* to have been for some years in use in the laboratory of the Royal Institution.

The exterior consists of a blue pot eighteen inches in height and thirteen inches in external diameter at the top. A small blue pot, of seven and a half inches internal diameter at the top, had the lower part cut off, so as to leave an aperture of five inches. This, when put into the larger pot, rested upon its lower external edge, the tops of the two being level. The interval between them, which gradually increased from the lower to the upper part, was filled with pulverized glass-blowers' pots, to which water enough had been added to moisten the powder, which was pressed down by sticks, so as to make the whole a compact mass. A round grate was then dropped into the furnace, of such a size that it rested an inch above the lower edge of the inner pot: the space beneath it therefore constituted the air-chamber, and the part above it the body of the furnace. The former is $7\frac{1}{2}$ inches from the grate to the bottom, and the latter $7\frac{1}{2}$ inches from the grate to the top; a horizontal hole, conical in form, and $1\frac{1}{2}$ inch in diameter on the exterior, was cut through the outer pot, forming an opening into the air-chamber at the lower part, its use being to receive the nozzle of the bellows. Care must be taken that the furnace is perfectly dry before it is used.

The fuel employed is coke, and the furnace is used with a pair of double bellows mounted on an iron frame, the furnace being raised upon an iron stool so as to bring the aperture of the air-chamber to a level with the nozzle of the bellows.

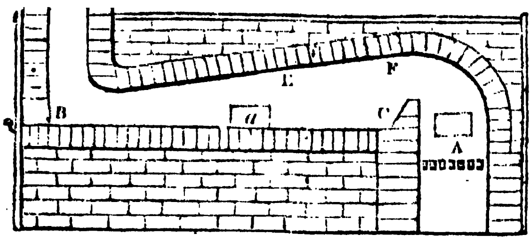
This furnace is sufficiently powerful to melt pure iron in a crucible in 12 or 15 minutes, the fire having been previously lighted. It will effect the fusion of rhodium, and even pieces of pure platinum have sunk together into one button in a crucible heated by it; all kinds of crucibles, including the Cornish and the Hessian, soften, fuse, and become frothy in it.

The *assay* or *cupelling furnace* is a small furnace made of iron, lined with refractory clay, and containing a muffle

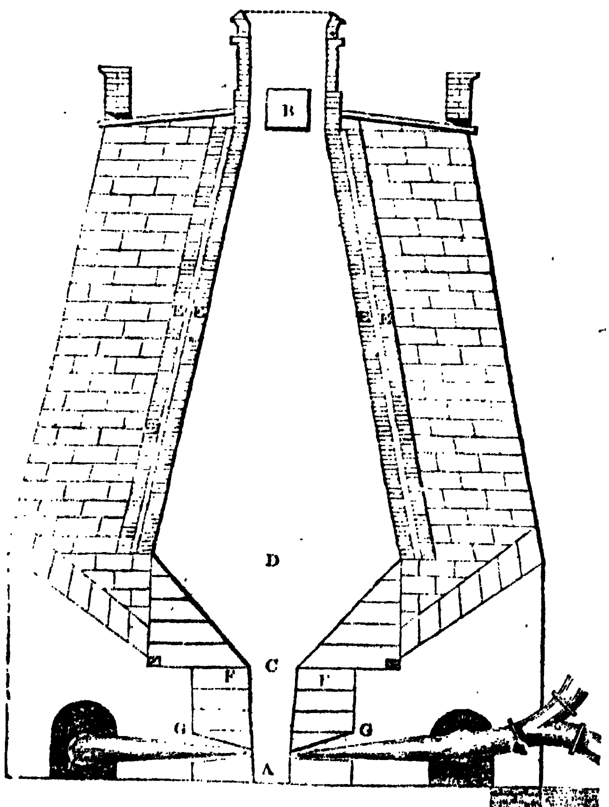


[MUFFLE]; it is used principally for the cupellation of gold and silver, which is placed upon a cupel in the muffle, previously heated to redness. The interior of the furnace contains merely the muffle resting upon two bars of iron; it is put about two-thirds into the furnace, and there is consequently left a space between it and the back part of the furnace: *a* is the orifice of the muffle, which may be closed by iron slides placed at the side. The opening *b*, placed below the grate, and which is also provided with slides, serves as well as the upper opening *c* to regulate the draught. Charcoal is used in this furnace.

For metallurgic operations on the large scale, as well as in making alkalis, red lead, &c., the *reverberatory furnace* is much used. This is shown in the annexed figure.



A is the space furnished with a grate or bars, to contain the combustible, which is either coke, coal, or wood, according to circumstances; B E F is the part on which the flame acts, E F is the roof, B C the hearth on which the substance to be heated is placed, and this is either horizontal or inclined; lastly, C is a low wall or the *bridge of the furnace*, which retains the fuel in its place, and serves to direct the flame towards the roof: *a* shows the opening of the furnace, usually placed at its side; through this the substance to be heated is introduced, and it is afterwards closed; often also there is an opening at B, to allow of a melted metal to flow out. H is a very high chimney that produces the draught, and which may be closed by a damper. As this furnace is employed for a vast number of purposes, it is evident that various forms must be used; these however it will not be necessary to describe.



Coke Pig-Iron Furnace.

The *coke pig-iron furnace* (see preceding figure) is that used in South Wales in the making of pig-iron; the height of this furnace, from the bottom at A to the filling-place at B, is 50 feet; the height of the hearth, from A to C, 8½ feet; from C to the top of the boshes at D, 8½ feet. The diameter of the hearth from A to C increases from 3 feet to 3½ feet. The extreme width at the top of the boshes D is 11 feet. The diameter of the charging-place B is 6 feet.

E E E E, the lining, is composed of a double circle of fire-bricks, about 15 inches long each, with a space for an intermediate packing of sand. F F, the hearth, is constructed of large blocks of breccia, or plum-pudding stone; G G are the twyres, or openings by which the blast is discharged into the furnace from the blowing cylinder, which is worked by a steam-engine. The contents of this furnace are 5015 feet; and it is capable of producing 100 tons of pig-iron weekly.

FURNA'RIUS. [CREEPER, vol. viii. p. 148.]

FURNEAUX'S ISLANDS. [BASS'S STRAITS.]

FURNES, or VEURNE, a small town in West Flanders, within three miles of the sea-coast, between Nieuport and Dunkerque, in 51° 5′ N. lat., and 2° 42′ E. long., 12 miles east from Dunkerque, and 26 south-west from Bruges. The town was anticntly close to the sea, but having been destroyed by the Normans it was rebuilt on its present site by Baldwin, surnamed Iron-arm. A battle was fought on the plains of Furnes in 1297, between Count Robert of Artois, commanding the troops of Philip the Fair, and Count Guy of Flanders, who commanded for Edward the First of England. Furnes has often been taken by the French; it was carried by Louis XV. in 1744, and restored by him in 1748, under the treaty of Aix-la-Chapelle. It came into the possession of the French at the beginning of the Revolution, and formed part of the department of the Lys until 1814.

The town is well built, and in 1830 contained 756 houses, inhabited by 954 families, and 4253 individuals. There are a cathedral, two churches, a chapel, an hospital, a college, and several convents. A brisk trade is carried on in various kinds of agricultural produce, and the town contains tanneries, breweries, ropewalks, salt refineries, and oil-mills.

Furnes was a place of some importance before the late peace, on account of its fortifications, which have since been demolished.

FURNES CANAL. This work begins at the town of that name, where it is connected with the canals of Bergues, of Loo, and of Dunkerque, and is carried to Nieuport, a distance of five miles and three-quarters. It thus forms part of the canal communication between Bruges and Dunkerque, which is of importance to the trade of the province, and is especially useful for the conveyance of coals. Some considerable works are in progress at Nieuport, which will render this canal further useful for discharging the superfluous water of the Yser into the North Sea.

FURNESS ABBEY. [LANCASHIRE.]

FURRUCKABAD, a district in the province of Agra, forming part of the Doab of the Jumna and Ganges, and lying between 27° and 28° N. lat. This district is bounded on the north by Bareilly and Alighur, on the east by Bareilly, on the south by Etawah and Caunpore, and on the west by Alighur. Previous to 1801 Furruckabad was under a Patan chief, who was tributary to the king of Oude; but in that year, by an arrangement made between the English and that monarch, the tribute was transferred to the East India Company, and in the following year, by a further arrangement made with the nabob of Furruckabad, the Company assumed the civil and military government of the district, making a fixed annual allowance to the nabob of 180,000 rupees (18,000*l.*) It is hardly possible to give too unfavourable a description of the state of anarchy and lawless violence which previous to that time reigned throughout the district. There did not exist even the semblance of a court of justice, in which criminal acts could be punished or civil wrongs redressed. No well-disposed person durst remain abroad after night-fall; houses were forcibly entered by robbers even in the day-time, and murders were commonly perpetrated in the streets in the face of day. Since

the English have assumed the government these evils have been redressed, the persons and property of the inhabitants have been effectually protected; gangs of robbers have been extirpated; and as the consequence of this alteration, the value of houses and land has increased many fold, the assessment has been punctually paid, and cultivation has been greatly extended. According to a statistical return made by the collector of the district in 1813, there were then in cultivation 1,805,383 small begahs, about 600,000 acres of land, the revenue assessed upon which was 10,28,485 rupees (102,848*l.*), or about 3*s.* 5*d.* per acre: there were further at that time 2,97,350 begahs fit for cultivation, and 10,46,704 begahs of waste land in the district, the extent of which appears therefore to be about 1640 square miles.

FURRUCKABAD, the capital of the district, is situated at a short distance from the western bank of the Ganges, in 27° 24′ N. lat., and 79° 27′ E. long.: this is one of the principal towns of Upper Hindustan. It is inclosed by a wall; the streets are wide, and in the best parts of the town the houses are good, and surrounded by trees, but the greater part of the dwellings within the walls are wretched mud hovels. An actual survey of the town was made in 1811, at which time it contained 13,348 dwellings and 1651 shops. Allowing the usual number of five persons to a dwelling, the population must then have amounted to 66,740 persons, exclusive of the floating population, visitors and strangers, which, as Furruckabad is the chief emporium of trade in the ceded and conquered provinces, are always present there in considerable numbers.

FURS and FUR TRADE. The use of furs appears to have been introduced into civilized Europe by the northern conquerors. In the sixth century the skins of sables were brought for sale from the confines of the Arctic Ocean to Rome, through the intervention of many different hands, so that the ultimate cost to the consumer was very great. For several centuries after that time furs could not have become at all common in western Europe. Marco Polo mentions as a matter of curiosity in 1252, that he found the tents of the Cham of Tartary lined with the skins of ermines and sables which were brought from countries far north, from *the land of darkness*. But in less than a century from that time the fashion of wearing furs must have become prevalent in England, for in 1337 Edward the Third ordered that all persons among his subjects should be prohibited their use unless they could spend one hundred pounds a year. The furs then brought to England were furnished by the traders of Italy, who procured them from the north of Asia.

The fur trade was taken up by the French colonists of Canada very soon after their first settlement on the St. Laurence, and through the ignorance of the Indians as to the value of the skins which they sold, and of the trinkets and other articles which they took in payment, the traders at first made very great profits. The animals soon became scarce in the neighbourhood of the European settlements, and the Indians were obliged to extend the range of their hunting expeditions, in which they were frequently accompanied by one or other of the French dealers, whose object it was to encourage a greater number of Indians to engage in the pursuit and to bring their peltries, as the unprepared skins are called, to the European settlements. When the hunting season was over the Indians came down the Ottawa in their canoes with the produce of the chase, and encamped outside the town of Montreal, where a kind of fair was held until the furs were all exchanged for trinkets, knives, hatchets, kettles, blankets, coarse cloths, and other articles suited to their wants, including arms and ammunition. A large part of the value was usually paid to the Indians in the form of ardent spirits, and scenes of riot and confusion were consequently of frequent occurrence.

The next stage of the Canadian fur trade was when some of the European settlers, under the name of *Coureurs des Bois*, or wood-rangers, set out at the proper season from Montreal in canoes loaded with various articles considered desirable by the Indians, and proceeded up the river to the hunting-grounds. Here they remained for an indefinite time, sometimes longer than a year, carrying on their traffic with the Indian hunters, and when their outward investments were exhausted, they returned, their canoes in general loaded with packs of beaver-skins and other valuable peltries. While engaged in these expeditions some of them adopted the habits of the tribe with whom they were associated, and formed connexions with the Indian women. This trade was for some time extremely profitable; the men by whom it was conducted, the *Coureurs des Bois*, were usually without capital, and their investments of European goods were furnished by the storekeepers of Montreal, who drew at least their full proportion of profit from the adventure. The return cargo was generally more valuable than the investments, in the proportion of six to one. Thus where the investment amounted to one thousand dollars, and the peltries returned sold for six thousand, the storekeeper first repaid himself the original outlay, and usually secured for himself an equal amount for interest and commissions, after which the remaining 4000 dollars were divided between himself and the Coureur des Bois.

The Hudson's Bay Company, established with the express object of procuring furs, was chartered by Charles the Second in 1670, with the privilege of exclusively trading with the Indians in the vast and not well defined region lying to the north and west of the great inlet from which the Company takes its name. This association founded several establishments, and has ever since prosecuted the trade under the direction of a governor, deputy-governor, and a committee of management chosen from among the proprietors of the joint-stock, and resident in London. The Company's charter never having been confirmed by Act of Parliament, it was considered that all British subjects were entitled to engage in the trade with those regions, and in conformity with this notion a partnership was formed in 1783 under the name of the North-West Company, which proved a powerful competitor. This Company consisted of twenty-three shareholders, or partners, comprising some of the most wealthy and influential British settlers in Canada, and employed about 2000 persons as clerks, guides, interpreters, and boatmen, or *voyageurs*, who were distributed over the face of the country. Such of the shareholders as took an active part were called agents, some of them resided at the different ports established by the Company in the Indian territory, and others at Quebec and Montreal, where each attended to the affairs of the association. These active partners met once in every year at Fort William, one of their stations near the Grand Portage on Lake Superior, in order to discuss the affairs of the Company, and agree upon plans for the future. The young men who were employed as clerks were, for the most part, the younger members of respectable families in Scotland, who were willing to undergo the hardships and privations accompanying a residence for some years in these countries, that they might secure the advantage of succeeding in turn to a share of the profits of the undertaking, the partners, as others died or retired, being taken from among those who, as clerks, had acquired the experience necessary for the management of the business. This Company had a settlement called Fort Chippewyan, on the Lake of the Hills, in 110° 26′ W. long., and some of the Indians who traded with the persons stationed at this fort came from beyond the Rocky Mountains.

A great degree of jealousy and hostility arose between the respective agents of the Hudson's Bay and North-West Companies, which more or less impeded the operations of both parties for several years, until in 1821 a junction of the two was effected, and the trade has since been prosecuted peacefully and successfully; but their presumed exclusive right of trading throughout the vast region which they have made the scene of their operations, is still guarded with extreme jealousy. All the furs collected by the Hudson's Bay Company are shipped to London, some from their factories of York Fort, and on Moose River, in Hudson's Bay; other portions from Montreal, and the remainder from the Columbia River.

The fur-trade is prosecuted in the north-western territories of the United States by an association called the North American Fur Company, the principal managers of which reside in New York. The chief station of this Company is Michilimackinac, to which are brought all the peltries collected at the other ports on the Mississippi, Missouri, and Yellowstone rivers, and through the great range of country extending thence to the Rocky Mountains. This Company employs steam-boats for ascending the rivers, which penetrate with ease to regions which could formerly be explored only through the most painful exertions in keel-boats and barges, or by small parties on horseback or on foot.

The ermine, called by way of pre-eminence 'the precious ermine,' is found almost exclusively in the cold regions of

Europe and Asia. The stoat (which in fact is identical with the ermine), but the fur of which is greatly inferior to that of the European and Asiatic animal, is found in North America. The fur of the ermine is of a pure whiteness throughout, with the exception of the tip of the tail, which is black; and the spotted appearance of ermine skins, by which they are peculiarly known, is produced by fastening these black tips at intervals on the skins. The animal is from 14 to 16 inches long from the nose to the tip of the tail, the body being from 10 to 12 inches long. The best fur is yielded by the oldest animals. They are taken by snares and in traps, and are sometimes shot, while running, with blunt arrows. The sable is a native of Northern Europe and Siberia. The skins of best quality are procured by the Samoieds, and in Yakutsk, Kamtchatka, and Russian Lapland: those of the darkest colour are the most esteemed. The length of the sable is from 18 to 20 inches. It has been considered by some naturalists a variety of the pine-marten. Martens are found in North America as well as in Northern Asia and the mountains of Kamtchatka: the American skins are generally the least valued; but many among them are rich and of a beautiful dark-brown olive colour. The fiery fox, so called from its brilliant red colour, is taken near the north-eastern coast of Asia, and its fur is much valued, both for its colour and fineness, in that quarter of the world. Nutria skins are obtained from South America, and the greater part of the importations in this country come from the states of the Rio de la Plata. [COYPOU.] These skins are of recent introduction, having first become an article of commerce in 1810: the fur is chiefly used by hat-manufacturers, as a substitute for beaver. Sea-Otter skins were first sought for their fur in the early part of the eighteenth century, when they were brought to Western Europe from the Aleutian and Kurile Islands, where, as well as in Behring's Island, Kamtchatka, and the neighbouring American shores, sea-otters are found in great numbers. The fur of the young animal is of a beautiful brown colour, but when older the colour becomes jet-black. The fur is exceedingly fine, soft, and close, and bears a silky gloss. Towards the close of the eighteenth century furs had become exceedingly scarce in Siberia, and it became necessary to look to fresh sources for the supply of China and other Asiatic countries. It was about the year 1780 that sea-otter skins were first carried to China, where they realised such high prices as greatly to stimulate the search for them. With this view several expeditions were made from the United States and from England to the northern islands of the Pacific and to Nootka Sound, as well as to the north-west coast of America. The Russians then held and still hold the tract of country most favourable for this purpose, but the trading ships which frequent the coast are enabled ...re these skins from the Indians. Fur-seals are in great numbers in the colder latitudes of the southern hemisphere. South Georgia, in 55° S. lat., was explored by Captain Cook in 1771, and immediately thereafter was resorted to by the colonists of British America, who conveyed great numbers of seal skins thence to China, where very high prices were obtained. The South Shetland Islands, in 63° S. lat., were greatly resorted to by seals, and soon after the discovery of these islands in 1818, great numbers were taken: in 1821 and 1822 the number of seal skins taken on these islands alone amounted to 320,000. Owing to the system of extermination pursued by the hunters, these animals are now almost extinct in all these islands, and the trade for a time at least has ceased. The seal-fishery, or hunting, in the Lobos Islands, is placed under restrictive regulations by the government of Monte-video, and by this means the supply of animals upon them is kept pretty regular.

Bears of various kinds and colours, many varieties of foxes, beavers, racoons, badgers, minks, lynxes, musk-rats, rabbits, hares, and squirrels, are procured in North America. Of all the American varieties, the fur of the black fox, sometimes called the silver fox, is the most valuable; next to that in value is the fur of the red fox, which is exported to China, where it is used for trimmings, linings, and robes, which are ornamented in spots or waves with the black fur of the paws of the same animal. The fur of the silver-fox is also highly esteemed. This is a scarce animal, inhabiting the woody country below the falls of the Columbia river. It has long thick fur of a deep lead colour, intermingled with long hairs white at the top, forming a lustrous silver-gray, whence the animal derives its name. The hides of bisons (improperly called buffaloes), of the sheep of the Rocky Mountains, and of various kinds of deer, form part of the fur-trade of North America; and sometimes the skin of the white Arctic fox and of the Polar bear are found in the packs brought to the European traders by the most northern tribes of Indians.

There is but one species of fur which is peculiar to England, the silver-tipped rabbit of Lincolnshire. The colour of the fur is grey of different shades, mixed with longer hairs tipped with white. This fur is but little used in England, but meets a ready sale in Russia and China; the dark-coloured skins are preferred in the former country, and the lighter-coloured in China.

The fur-sales of the Hudson's Bay Company are held every year in the month of March, and being of great magnitude, they attract many foreign merchants to London. The purchases of these foreigners are chiefly sent to the great fair in Leipzig, whence the furs are distributed to all parts of the continent of Europe.

Number of Skins of Fur-bearing Animals imported into the United Kingdom in the year 1835, distinguishing the Countries whence they were imported.

COUNTRIES WHENCE IMPORTED.	Bear.	Beaver.	Fitch.	Marten.	Mink.	Musquash.	Nutria.	Otter.	Seals.
Germany	—	67	37,799	28,280	7,237	—	—	98	870
Russia	1	—	—	—	—	—	—	—	1,030
Prussia	—	—	39						
Holland	—	—	8,836	2,741					
Belgium	—	—	42	6					
France	1	—	818	10,488					
British North American colonies	4,829	85,933	12	71,068	25,297	1,147,725	4	17 989	822,186
United States of America	10,184	2,316	40	47,253	82,950	23,232	—	143	2,081
British West Indies	1								
E. I. Compy. Territories	9	—	—	—	—	—	—	1	
Chili	2	1	—	1	1	2	—	—	2,813
Peru	—	—	—	—	—	—	—	—	2,222
Guernsey, Jersey, &c.	14	83	—	117	16	700	—	120	
Cape of Good Hope	—	—	—	—	—	—	7	20	4,455
New South Wales	—	—	—	—	—	—	—	—	1,442
Mauritius	—	—	—	—	—	—	5		
Brazil	—	—	—	—	—	—	284	3	5
States of Rio de la Plata	—	—	—	—	—	—	557,360	—	43
The Whale Fisheries	—	—	—	—	—	—	—	—	2,536
	15,041	88,400	47,586	159,954	115,501	1,171,659	557,600	18,374	839,683

The Numbers re-exported in the same year, of those species of which the Custom-House Returns have been given, were:—

Countries to which exported.	Bear.	Marten.	Musquash.	Otter.
Russia . . .	331	—	—	—
Prussia . . .	85	—	—	650
Germany . . .	8,753	5,106	6,507	13,157
Holland . . .	207	351	50,425	205
Belgium . . .	—	188	—	—
France . . .	1,663	11,222	—	—
Italy	229	—	—	—
Turkey . . .	—	281	—	—
China	—	—	—	520
United States of America . .	146	813	164,558	9,912
	11,414	17,961	221,490	24,444

The value of the fur trade to Russia is shown by the following official table of exports from that empire, in each year from 1827 to 1835:—

	To England.	To other Countries.	Total.
1827	£10,230	£483,210	£493,440
1828	2,559	135,647	138,206
1829	9,926	108,373	118,299
1830	3,329	120,021	123,350
1831	5,023	80,203	85,226
1832	7,353	122,791	130,144
1833	14,162	91,243	105,405
1834	55,357	113,021	168,378
1835	4,340	94,218	98,558

FÜRSTENBERG, a principality under the sovereignties of the king of Würtemberg and grand-duke of Baden, consisting of several mostly isolated bailiwicks on the rivers Danube, Wutach, and Kinzig, the majority of which are situated in the Würtemberg circle of the Danube and the Baden circle of the Lake. They have an area of about 787 square miles, and a population of about 92,000; and comprise 18 towns and 4 market villages, besides 195 villages, hamlets, &c. The principality is mountainous, and produces timber, cattle, iron, copper, silver, &c. In the upland districts, in the western region of the Black Forest, the inhabitants are employed in making articles of wood, particularly wooden clocks. The prince's residence is Donau-Œschingen, where he has his chancery and public offices. He is also possessed of several seigniorialities in Bohemia; and his yearly income is estimated at from 500,000 to 600,000 guilders, from about 46,000*l.* to 55,000*l.* sterling. Donau-Œschingen, in 48° 56′ N. lat. and 8° 31′ E. long., is situated at the confluence of the three streams whose united waters form the Danube. It contains about 400 houses and 3100 inhabitants. The palace, high church, archivarium, public offices, and riding-house and stables are handsome modern buildings: the town has also a gymnasium, and a very extensive establishment belonging to the prince, in which great quantities of beer and brandy are made.

FÜRTH (in Latin records *Trajectum* or *Furthum*), a circle in the Bavarian province of the Retzat, comprising a few small parishes and the town of the same name, which is situated in a fertile plain and at the confluence of the Rednitz and Pregnitz; about four miles north-west of Nuremberg, in 49° 28′ N. lat. and 11° 1′ E. long. It contains about 1240 houses, and 13,850 inhabitants, of whom upwards of 11,000 are Lutherans and 3550 Jews. The site was originally a 'Villa Regia,' or royal domain and mansion, in which many of the German nobles assembled in 907 in council with the emperor Lewis. The bishops of Bamberg enjoyed it by gift from the emperor Henry II.; and it afterwards became part of the Margraviate of Anspach, in conjunction with which it was annexed to the crown of Bavaria in 1803. There are three churches, one of which is Roman Catholic, a splendid synagogue, and three minor places for Jewish worship; the high church contains one of the oldest and largest organs in Germany. The Jews have a sort of university here called a Talmud school, where their learned men and rabbis are educated, two printing-houses, three minor schools, a lay and ecclesiastical court of justice, and a hospital, with an establishment for the employment of their poor and the care of orphans. Fürth has also a townhall, a grammar and a superior civic school, twenty elementary and Sunday schools, an hospital, theatre, &c. The market-place, a large open area, occupies the tongue of land formed by the confluence of the Rednitz and Pregnitz. Independently of a brisk transit trade, Fürth is the residence of a number of small manufacturers, whose productions are looking-glasses, chandeliers, glass, sealing-wax, pocket-books, pencils, needles, spectacles, cabinet work, turnery, false gold leaf (*Leon-gold*), clocks, jewellery, saddles and harness, locks, &c. Some cottons, caps, and stockings are also woven. There is an annual fair at Michaelmas, which lasts fourteen days.

FUSCIN, a brownish matter insoluble in water but dissolved by alcohol, obtained from empyreumatic animal oil. [OIL, ANIMAL.]

FUSEE. [HOROLOGY.]

FU'SELI, HENRY, was the second son of John Caspar Fuessli, a portrait and landscape painter, and author of 'Lives of the Helvetic Painters.' He was born at Zürich in Switzerland, 7th February, 1741. The elder Fuessli gave his son a classical education, and brought him up for the church. He accordingly entered the Caroline College at Zürich, where he subsequently took his degree of Master of Arts. He entered into holy orders in 1761; but having written a pamphlet, in conjunction with Lavater, in which the conduct of an unjust magistrate was exposed, his friends deemed it prudent to oblige him to travel for a while, in order to avoid the vengeance of the disgraced magistrate's family, who still retained considerable power. After travelling in Germany, he came to England, partly it appears as an agent for the purpose of establishing some regular plan of literary communication between that country and his native place. Sir Andrew Mitchell, the British minister at the court of Prussia, furnished him with introductions. Among others, he became acquainted with Mr. Millar (afterwards succeeded by Mr. Cadell) and Mr. Johnson, two eminent publishers; and he supported himself for some time by translating from German, French, and Italian into English, and from English into German. The 'Letters' of Lady M. W. Montagu were among the works he translated into German. In 1765 he published a translation of Winckelmann's 'Reflexions on the Painting and Sculpture of the Antients.' In the following year he set out as travelling tutor to Lord Chewton, the eldest son of Earl Waldegrave; but he soon threw up his charge in displeasure. About this time he became acquainted with Sir Joshua Reynolds, to whom he showed some of his drawings. Reynolds recommended him to devote himself entirely to painting, and he followed the advice.

In 1770 he went to Italy, at which time he altered his name to Fuseli, to suit the Italian pronunciation, and this form he retained after his return to England. In 1778 he visited Zürich on his way back to England. On his return he was engaged by Alderman Boydell, with other artists, to paint pictures for the Alderman's Shakspeare Gallery. About the same period he edited the English edition of Lavater's work on physiognomy, and assisted Cowper in his translation of Homer, with remarks and corrections. In 1788 he married Miss Sophia Rawlins, of Bath Eaton, and subsequently was elected an Associate of the Royal Academy, with a view, it is said by his biographer, to the pension allotted by that body to the widows of its deceased members. In 1790 he was elected Royal Academician. In 1799 he completed a number of pictures, designed from the works of Milton, to form a Milton Gallery, the idea of which was suggested by the Shakspeare Gallery; but he realized nothing by their exhibition. In the same year he was elected Professor of Painting to the Royal Academy, and, in 1803, Keeper. His edition of Pilkington's 'Lives of the Painters' was brought out in 1805. Canova, upon his visit to England, was much struck with Fuseli's works; and on the sculptor's return to Rome, at his recommendation Fuseli was elected a member of the first class in the Academy of St. Luke's. Fuseli died April 15, 1825, and was buried in the crypt of St. Paul's Cathedral.

In the earlier portion of his life Fuseli was very susceptible of the passion of love, and appears to have formed many attachments. He was in like manner favoured with the affections of more ladies than one; but, until he met with the lady whom he married, a curious perversity seems

to have prevented any of the more serious attachments from being mutual. Among others, Miss Wollstonecraft avowed a passion for him, which was not returned. He was short in stature, but robust, with strongly marked features, and an energetic countenance. Harlow's portrait, in little, is esteemed the best likeness of him extant, as it is perhaps the best picture Harlow ever produced. Fuseli had great facility in learning languages. He said that he could think and write with equal ease in French, Italian, and English, but with most power in German. His English writings are in a style not purely idiomatic, but they are full of nerve and originality of expression. His lectures contain (if we except some of his remarks upon contemporaries, which were sometimes all but unavoidably modified by personal feelings), some of the best criticism on the fine arts in the language. Though singularly abrupt and irritable in temper, he made and retained many friendships which were only broken by death. Lavater, Bonnycastle, and Johnson (the publisher), were among the oldest of his friends, and he survived them all. Many curious anecdotes are told of the freedom and quaintness with which he passed his strictures on all persons in matters of art, literature, or manners.

Fuseli made the works of Michel Angelo his chief study. He also moulded his style much upon the model of the colossal statues on Monte Cavallo, at Rome. His colouring is low in tone, and overspread with a sickly, greenish, leaden, or yellowish hue: his hand hasty, and not skilful. He would sometimes work with his colours dry in the powder, rubbing them up with his brush. Probably from a deficiency in his early study, his drawing was not so correct as his ambition was daring. His anatomy sometimes resembles the mechanical and coarse ostentation of an artificial myotomical model rather than the free, varying, and blended forms of nature. The proportions are frequently exaggerated, and the action violent and intemperate. In his desire to display the naked figure, he often sacrifices his better knowledge, and violates all rules of costum and there is sometimes much that is extravagant and fantastical in his design. His figures set about the commonest occupations, straining every feature, finger, and with superfluous energy. His 'Hamlet breakin from his attendants to follow the Ghost' is in a preposterously contorted attitude, and he looks as though he would burst his clothes with convulsive cramps in all his muscles. In an illustration to Cowper's Poems, a gentleman is seated at a family breakfast table without a waistcoat and with his hat on: his legs, which are curiously crossed, seem naked till the slight border of the trowser is perceived. On the other hand, there is always life and action in his figures, some event going forward in the design. His ople seem in earnest. In dreamy or terrible subjects he is often grand and impressive. His 'Nightmare' is imaginative and full of feeling. His 'Sin pursued by Death' is truly a fine picture. Death is fitly hideous, and the female is a ghastly mixture of spectral paleness and voluptuousness. Fuseli loved his art with a genuine affection, and the bold and original thoughts of his vigorous if not exalted mind were impressed upon the canvass without misgiving. He only wanted a better training of his hand, and a more temperate habit of thinking, to have made a great painter. As it is, he has helped to vindicate the supremacy of design (including invention) and expression over the inferior parts of the art, and has done much to advance a better taste in this country. (Knowles.)

FUSION. The different temperatures at which certain solids are rendered fluid have been already mentioned. [FREEZING POINTS.] In addition it may be merely remarked that fusion is sometimes used with the prefix of *watery*, and at other times *igneous*. Watery fusion is that which occurs when a salt, such as sulphate of soda for example, containing much water of crystallization fuses or melts in its water by exposure to a moderate heat; it may afterwards undergo igneous fusion by exposure to a much higher temperature.

FUST, or FAUST, JOHN, an opulent citizen of Mayence, a goldsmith by trade, whose name appears as one of the inventors of the art of printing, in the manner in which that art is effected by movable metal types. Gutenberg and Schoeffer were the two others. Schoeffer, by inventing the puncheon, is supposed to have given completion to the discovery. It is not however quite certain that Fust did more than supply money to Gutenberg, who had made attempts with movable metal types at Strasburg, before he removed to Mayence in 1444-1445. Fust entered into partnership with him; but soon after, in consequence of a law suit, the partnership was dissolved, and the whole of Gutenberg's printing apparatus fell into Fust's hands, who ultimately, with the assistance of Peter Schoeffer, made the invention useful to the world. The Latin Bible in folio, commonly called the Mazarine Bible, executed between 1450 and 1455, if it was not by Gutenberg, is supposed to be the earliest production of their press.

The books with dates which bear the joint names of Fust and Schoeffer are: 1. The Latin Psalter of 1457, in large folio; the type of the size used in the great service books of the Romish Church. At the end is this subscription—

> "Adinuentione artificiosa imprimendi ac caracterizandi absque calami ulla exaratione sic effigiatus. Et ad eusebiam dei industrie est consummatus per Johannem fust Cinem Maguntioum. Et Petrum Schoffer de Gernszheim. Anno dni Millesimo CCCC.LVII. In vigilia Assumptionis."

2. The Psalter of 1459; with some variations from the preceding, but in the same size and letter. 3. The 'Rationale divinorum Officiorum' of Durand, 1459, fol. maj.; the first specimen of the smaller type of Fust and Schoeffer. 4. The Clementine Constitutions, 1460, fol. maj. 5. Joannis Balbi de Janua Catholicon, 1460, fol. maj. 6. The Latin Vulgate Bible, 2 vols., 1462, fol. maj. Copies of this Bible are oftener found printed upon vellum than on paper, but both are rare. 7. The German Bible, fol. maj. [Known to have been printed in 1462, or thereabout.] Reprinted in 1465. 8. 'Bulla Papæ Pii II.' Germ. 1463, fol. maj. 9. 'Liber sextus Decretalium Bonifacii VIII. Pont. Max.' 1465, fol. maj.: a second, or at least a varying impression of this work appeared in the same year. 10. Cicero's Offices and 'Paradoxa,' 1465, sm. fol.: the first edition of Cicero with a date. 11. Cicero's Offices and Paradoxa, 1466, sm. fol. Copies of this edition are more common upon vellum than on paper: that of 1465 is very rare upon vellum. 12. 'Grammatica rhytmica,' 1466, fol. min. It consists of eleven leaves in the smallest fount of type of these printers, and is of extreme rarity; two or three copies only are known.

The following works without date, from the close resemblance of their typography, are assigned without scruple by our best bibliographers to the press of Fust and Schoeffer. 1. 'Bulla Cruciata sanctissimi Domini nostri Papæ contra Turcos,' fol. in six printed leaves. It has no place or name. The type is like the Durand. 2. 'Laus Virginis,' folio, nine leaves. The device of the shields in red, at the end, seen in so many of these printers' works, decidedly justifies its being placed as the production of Fust and Schoeffer's press. 3. 'S. Aurelii Augustini de Arte prædicandi Tractatus,' folio: supposed to have been printed about 1466. It consists of twenty-two leaves. 4. 'Ælius Donatus de Octo partibus Orationis,' 4to.; the type of the smaller size, resembling the Latin Bible of 1462 and the Cicero of 1465.

With an exception or two, the whole of Fust and Schoeffer's productions are in the collection at the British Museum.

Fust, whose name appears with Schoeffer's for the last time in 1466, is supposed to have died in that, or at latest in the next year, of the plague, at Paris. Schoeffer continued to print in his own name for a long time.

(Panzer, *Annal. Typogr.*, vol. ii., p. 111-117; *Bibliot. Spenceriana*, passim: *Biogr. Universelle*, tom. xvi. p. 205; Peignot, *Variétés, Notices, et Raretés Bibliographiques*, 8vo. Par. 1822, p. 78.)

FUSTIAN, a description of cotton fabrics similar in the mode of their manufacture to velvet, having in addition to the warp and weft common to all woven goods, a *pile* consisting of other threads doubled under the weft, and 'thrown in' at intervals so close together that when the goods are finished the interlacing of the warp and weft are concealed by them. [VELVET.] While in the loom the pile forms a series of loops, which are afterwards cut and sheared. The cutting is performed by running a knife through each series of loops as they occur in the weft; this gives an uneven and hairy appearance to the cloth, which is afterwards remedied first by the shearing process, and afterwards by singeing and brushing, which latter operations are re-

peated until the fustian has acquired a smooth and polished appearance. The shearing of fustians is a separate art; and several hundred persons are engaged in it in the town of Manchester alone. Until lately the operations were conducted by hand, but the aid of machinery has now been obtained, and instead of the tedious operation of cutting open only one set of loops at once, a series of knives are brought to act together and continuously, until the whole piece is finished, by which means the work is not only done more quickly, but is also better performed than when its excellence depended upon the uniform precision of the human hand.

Various kinds of fustians are made, and are known by different names, according to their form and fineness. The best kinds are known as cotton velvet and velveteen; besides these there are beaverteens, moleskin, corduroy, and cords. Different patterns are produced by different dispositions of the pile threads. Fustians are woven both in the hand-loom and with the power-loom; they are made of different widths, some pieces being 18 and others 27 inches wide: a piece of velveteen of medium quality, 90 yards long and 18 inches wide, weighs about 24 or 25 lbs. The yarn for the warp is made of New Orleans cotton, or of Upland Georgia and Brazil cotton mixed, of the fineness of 32 hanks to the pound; the weft and pile are usually spun from Upland mixed with East India cotton, and the yarn is commonly of the fineness of 24 hanks to the pound. [COTTON SPINNING.]

FUSTIC. This name appears to be derived from *fustel*, the French name of a yellow dye-wood, the produce of Venetian sumach. A wood similar in colour and uses, but larger in size, having been subsequently imported from the New World, had the same name applied to it with the addition of *old*, while the other, being smaller, is called *young fustic*: but these, so far from being the produce of the same tree at different ages, do not even belong to the same genus.

Young Fustic, or, as it is sometimes called, *Zante Fustic*, is the produce of Rhus Cotinus (tribe *Anacardiaceæ*), a native of Italy, the south of France, and of Greece; much of it is exported from Patras in the Morea; and it also extends into Asia. It is supposed to be the Cotinus of Pliny, being still called *Scotino* near Valcimara, in the Apennines, where it is cultivated on account of its uses in tanning. The root and the wood of this shrub are both imported, deprived of their bark, and employed for dyeing a yellow colour approaching to orange, upon wool or cottons, prepared either with alum or the nitro-muriate of tin with the addition of tartar. The colour is a beautiful bright yellow, and permanent when proper mordaunts are employed. Only small quantities of this kind of fustic are imported.

Dr. Sibthorp was of opinion that *Rhamnus infectoria* or *oleoides*, of which the berries are called French and Persian berries, yielded the *fustic* of commerce, and informs us that its yellow wood is called by the Greeks *chrysoxylon*. He also thought that it was the *Lycium* of Dioscorides, but this has been shown by Dr. Royle to be a species of Berberis, of which genus all the species have yellow wood.

Old Fustic, the 'bois jaune' of the French, is on the contrary the produce of a large tree, *Morus tinctoria*, dyer's mulberry, of the natural family of Urticeæ, a native of Tropical America and the West India Islands. The tree attains a height of 60 feet; the wood is yellow coloured, hard, and strong, but easily splintered, and is imported in the form of large logs or blocks. The yellow colour which it affords with an aluminous base, though durable, is not very bright. M. Chaptal discovered that glue, by precipitating its tannin, enabled its decoctions to dye yellow almost as bright as those of weld and quercitron bark. The fustic from Cuba is preferred, and fetches the highest price, varying from 10*l*. to 12*l*., while that from Jamaica or Columbia varies from 8*l*. to 9*l*. a ton. The tree is figured by Sloane, and noticed by Marcgrave and Piso. Browne describes it as a native of Jamaica, and deserving the attention of planters, as it is only propagated by birds, who are fond of its sweet roundish fruit.

Fustic is admitted into England at the nominal duty of three shillings per ton from British Possessions, and four shillings and six-pence from other countries. The annual import for each of the ten years, ending with 1836, was—1827, 4111 tons; 1828, 7597; 1829, 7364; 1830, 5111; 1831, 6334; 1832, 4350; 1833, 9851; 1834, 14,047; 1835, 9930; 1836, 4917.

The several countries from which fustic was imported, and the respective quantities received from each, were, in 1836—

	Tons.
Italy and the Italian Islands	4
Ionian Islands	72
Morea and Greek Islands	18
British North American colonies	103
British West Indies	2053
United States of America	226
Mexico	172
Columbia	1913
Brazil	356
Total	4917

FUSUS. [SIPHONOSTOMATA.]

FUTTEHGHUR, a town in the district of Furruckabad distant 3 miles from the city of Furruckabad, on the western bank of the Ganges, in 27° 21′ N. lat. and 79° 30′ E. long. Futtehghur was formerly an important military station of the British government; but since the district has become more subject to the dominion of the law than it was when under the government of the nabob of Furruckabad, the number of the soldiers has been diminished, and is now quite inconsiderable. This town is the residence of the civil officers entrusted with the management of the conquered and ceded provinces, and several European merchants reside and carry on their business within its walls. During the dry season the Ganges is here reduced to two or three narrow channels winding slowly through a bed of sand, and at this time the town is hardly habitable because of the clouds of dust which are continually flying. The town contains an arsenal which is protected by a strong mud fort. The chief industry carried on within the town is the manufacture of tents, which are made of good materials and excellent workmanship. Futtehghur is distant 90 miles north-west from Lucknow, travelling distance.

FUTTIPORE, a town situated 19 miles south-west from the city of Agra, and within the province of that name, in 26° 6′ N. lat. and 77° 34′ E. long. The walls by which it is surrounded are of great extent. The inclosed space appears for the most part to have been always unprovided with buildings. The stone of which the walls are formed is furnished by quarries in the neighbourhood, which have also supplied the materials for building the houses, which are not numerous. The town was inclosed and fortified by the Emperor Akbar, whose favourite residence it was. It contains an extensive tomb, also built by Akbar, in which several members of the imperial family were buried: the palace which he inhabited has long been in ruins, while a small house, which is said to have been the residence of his favourite minister, is still in good preservation.

FUTURE. [TIME.]

FUZE, a short tube, made of well-seasoned beech, and fixed in the bore of a shell. It is filled with a composition, which, being fired by means of a small piece of quick-match inserted for the purpose, the shell is made to explode in consequence of the fire communicating with the powder with which it is charged. The length of a fuze is regulated by the intended range of the shell or by the intended time of its flight.

For the ingredients which enter into the composition, and for the manner of 'driving' the fuze, see Spearman's *British Gunner*.

FYZABAD, a town in the kingdom of Oude, situated on the south side of the Goggra river, in 26° 47′ N. lat. and 82° 3′ E. long., 2 miles west from Oude, the antient capital. In the reign of Shuja ud Dowlah, Fyzabad was made the capital, but the seat of government was transferred to Lucknow, in 1775, by his son and successor Azoph ud Dowlah. Shuja's palace is already in ruins. At the time just mentioned, the bankers and superior merchants accompanied the court to Lucknow, but the population is still numerous. The widow of Shuja ud Dowlah, known in history as the Bhow Begum, continued to reside in Fyzabad to the time of her death. She was possessed of great wealth, the amount of which, as is usual in the East, was much exaggerated. She wished to bequeath the whole of her property to the English government, but the offer was declined; and after providing for her other relations

and dependants, the bulk of her fortune descended to her grandson Ghazi ud Deen, king of Oude. It required a sum equal to about 680,000*l.* to provide for the payment of the various legacies and pensions bequeathed by the Begum's will, after which the king of Oude succeeded to landed property (jaghires) yielding 80,000*l.* per annum and money to the amount of 270,000*l.*, besides jewels, shawls, and cattle, the value of which was very great, but was not ascertained. Fyzabad is 78 miles east from Lucknow, travelling distance.

INDEX TO THE LETTER F.

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G.

G. This letter is derived from the Latin alphabet, in which it first appears. In the Greek alphabet its place is supplied by *zeta*. If, as seems probable, the sound of this Greek letter was the same as the consonantal sound at the beginning of the word *judge* (see Z), it may perhaps be inferred that the hissing sound now given to the letter *g* existed already in some dialect of antient Italy. The sound at any rate is familiar to the modern Italian. The sound of the letter *g* in the English language is two-fold. Before *a*, *o*, and *u*, and occasionally before *i* and *e*, it is the medial letter of the guttural order. The other sound, which it possesses only before *i* and *e*, is one of the medials of the sibilant series, and is also represented by the letter *j* as pronounced by the English. [ALPHABET, p. 379.] The sibilant sound is written in Italian by two letters, *gi*, as Giacomo, Jacob, or by *gg*, as *oggi*, to-day. The two-fold nature of the sound corresponds to the double sound of the letter *c*, which is sometimes a *k*, sometimes an *s*. [See C.]

The guttural *g* is liable to many changes in different dialects or languages.

1. *g* and *k* are convertible. Thus the Greek and Latin forms genu, γονυ; gen, γεν, as seen in gen,us, γεν,ος, gi,g(e)n,o, γι,γ(ε)ν,ομαι; gno, γνω, as seen in gno,sco, γι,γνω,σκω; severally correspond to the German and English *knie*, *knee*; *kind*, *kin*; *kenn,en*, *know*.

2. *g* and an aspirated guttural: as, Greek, χην; German, *gans*; English, *goose* and *gander*. Perhaps χαινω may be related to the German *gaffen* and English *gape*. There can be no doubt as to the connexion between the Greek χθες, the Latin *hes-ternus*, and the German *ges-tern*. The close connexion of the two sounds may also be seen in the pronunciation of the final *g* in high German like *ch*, as *Ludwig*, &c.

3. *g* and *h*. As the letter *h*, when pronounced at all, is only a weak aspirate, this interchange strictly belongs to the last head. As an additional example, we may refer to the Latin word *gallus*, which has all the appearance of being a diminutive, like *bellus*, *ullus*, *asellus*, from *benus*, *unus*, *asinus*. If this be admitted, the primitive was probably *ganus*; and we see its corresponding form in the German *hahn*, a cock.

4. *g* often disappears: First, at the beginning of a word, as in the Latin *anser*, a goose, compared with the forms given above, and in the English *enough* compared with the German *genug*. A large number of examples of this may be seen in the poetical participles of the English language, commencing with a *y*, as *yclept*, *yclad*, &c.: also in *ago* for *agone*; in all of which the fuller form began with *ge*, as is still seen in German. The loss of *g* is particularly common before *l* and *n*, as Eng. *like*, Germ. *gleich*; Lat. *nosco*, *nascor*, from *gnosco*, *gnascor*. Secondly, in the middle of words between vowels. This may be seen in French words derived from the Latin, as: *legere*, *lire*, read; *magister*, *maistre*, master; *Ligeris*, *Loire*, &c.; also in English words connected with German, as, *nagel*, *nail*; *segel*, *sail*; *regen*, *rain*, &c. In such cases the vowel is generally lengthened. Lastly, at the end of words, as, *sag-en*, *say*; *mag*, *may*; *tag*, *day*: here again the syllable is strengthened.

5. *g* and *y* are convertible: as, *yester-day*, compared with the Germ. *gestern*; *yawn* with *gähn,en*; *yellow* with *gelb*. In our own language we find related words showing this difference: *yard* and *garden*; *yate*, a dialectic variety of *gate*; *yave* for *gave* (Percy's *Reliques*, i., p. 294, note); and *yode*, a perfect of *to go* (Glossary of same).

6. *g* with *gu* and *w*. In the Latin language there co-exist the forms *tinguo*, *tingo*; *unguo*, *ungo*; *urgueo*, *urgeo*, &c. In the French language *gu* is presented to the eye, but *g* to the ear, in the following: *guerre*, *guêpe*, *guarder*, &c.; while in English we have *war*, *wasp*, *ward* or *guard*. Under this head it may be observed, first, that a final *w* in the English language often corresponds to a guttural in other Teutonic dialects, as *saw*, *raw*, *crow*, *row*, *maw*, &c.; secondly, that we often have two letters, *ow*, where the German has a guttural *g*, as *follow*, *sorrow*, *morrow*, *furrow*, *gallows*, *marrow*, *borrow*, *barrow*.

7. *g* and *b*. This is generally confined to those cases at the beginning of words, when an *r* or *l* follows, as in the Æolic forms, γλεφαρον, γληχων, γαλανος, in place of βλεφαρον, βληχων, βαλανος. Hence the Latin *glans*. So the Turks have given to Prussia the name of *Gharandaberk*, i. e. *Brandenburg*.

8. *g* and *d*: as δη-μητηρ for γη-μητηρ. Examples of this interchange may be heard from the mouth of nearly every child in its first attempts to speak, as *Dy Flot* for *Guy Fawkes*, *dood boy*, *do away*, &c. This change, as in the last case, is common before *l*; hence the Latin *dulcis* by the side of the Greek γλυκυς.

9. The guttural g and the sibilant g. It was stated in C that the hard sound of that letter in the Western languages of Europe often corresponded to a hissing sound in the Eastern. So too the hard *g* belongs to Europe, the *j* sound to Asia. Thus *reg*, a king, is in the East *rajah*.

10. The sibilant *g* and *di* or *bi* before a vowel. For examples see D and B.

11. *g* appears to attach itself to the letter *r* at the end of roots: as, *merg,o*, *sparg,o*, compared respectively with the Latin *mare* and the Greek σπειρω. This outgrowth corresponds to the addition of *d* at the end of roots ending in *n*. [See D.] The two liquids take as an addition the medial consonants of their own order, the dental *n* preferring the dental *d*, while *r* takes to it the guttural *g*.

G (in music), the fifth note or degree of the diatonic scale, answering to the *sol* of the Italians and French. It is also a name of the treble clef. [CLEF.]

GABION, a hollow cylinder of wicker-work, resembling a basket, but having no bottom. It is formed by planting slender stakes vertically in the ground, at intervals from each other on the circumference of a circle, and interweaving with them osiers or other flexible twigs.

The most usual kind of gabion is about 20 inches in diameter, and 2 feet 9 inches in height, but the stakes, whose extremities are pointed, project beyond the basket-work about 3 or 4 inches at each end. The lower ends of the stakes, by entering the ground, serve to keep the gabion in its place when set up; and as it is usual to increase the height of a row of gabions by placing along their tops a triple line of fascines, the upper ends of the stakes retain the fascines in their places by entering between the rods.

Such gabions are used during a siege in executing trenches by the process of sapping: for this purpose they are placed on end, with their sides inclining a little outwards, on that side of the line of approach which is nearest to the fortress; and, being filled with earth obtained by the excavation of the trench, they form a protection against the fire of the enemy. After the gabions are filled, the required thickness is given to the parapet of the trench by throwing the earth beyond the line.

Gabions of the same kind are sometimes used to form a revetment for the interior of the epaulement of a battery; being then placed on end in two or more horizontal rows, one above the other, and leaning against the mass of earth. Four or five gabions line each side or cheek of the embrasure at the neck or interior extremity of the latter.

What is called a sap-roller consists of a gabion placed within a larger one, so that their axes are coincident: each is about 6 feet long, but the diameter of the exterior gabion is 4 feet, and that of the other 2 feet 9 inches, and the interval between the two is filled with brushwood or any light material by which the whole may be rendered musket-proof. This is used to cover the sappers in front, while employed in excavating the approaches near the fortress, being rolled forward as the work advances.

It has been recommended to place a row of small gabions, in the form of frustums of cones, along the crest of a parapet, in order to cover the heads of the defenders: bags of earth are usually employed for this purpose: but if gabions should be preferred, their large ends must be placed upwards, so as to leave between every two at bottom a loophole for musketry.

A *gabionnade* is any lodgment consisting of a parapet hastily formed by placing on the ground a row of gabions, and filling them with earth obtained by digging a trench parallel to the line, in their rear

GABRES. [Guebres.]

GADEBUSCH, FREDERIC CONRAD, a learned German, born in 1719, in the island of Rugen. After having studied at different universities of Germany, he went, in 1750, to Livonia, where he remained till his death in 1788. He was a very laborious writer, and left several works in German, which throw considerable light on the history of the Baltic provinces of Russia. His principal works are: 'Memoir on the Historians of Livonia,' Riga, 1772; 'Livonian Bibliotheca,' Riga, 1779; 'Essays on the History and Laws of Livonia,' Riga, 1777-1785; 'Annals of Livonia, from 1030 to 1761,' 8 vols. in 8vo., Riga, 1780-1783.

GADES. [Cadiz.]

GADFLY. [Œstridæ.]

GADIDÆ, a family of fishes of which the common codfish may serve as the type. [Abdominales; Malacopterygii.]

GAEL, GAELIC. Although the language spoken by the Scottish Highlanders is familiarly known among the Lowlanders by the name of the *Erse*, or, according to the more usual pronunciation, the *Ersh*, that is, plainly, the Eirish or Irish, the people themselves are never called by that name. Among the Highlanders the name Erse is unknown, either as that of the nation or of the language. They call themselves only the *Gadhel*, also sometimes written and always pronounced *Gael*, and their language the *Gaedheilg*, pronounced *Gaeilg*, or, nearly *Gaelic*. The name *Gaelic* is also in familiar use among the Lowlanders as that of the language. Further, the only name by which the Irish are known to the Scottish Highlanders is *Gael*: the latter call themselves *Gael Albinnich*, or the Gael of Albin, and the Irish *Gael Erinnich*, or the Gael of Erin. The Irish also call themselves the *Gadhel*, or *Gael*, and their language the *Gaelic*. Finally, the Welsh call the Irish *Gwyddel*, which is evidently the same word with *Gadhel*, or *Gael*.

This is nearly all that can be stated as matter of fact in regard to the name *Gael*. The rest is all speculation and conjecture: of that, however, few words have given rise to so much. We shall not here attempt to do more than to indicate and arrange the various points as to which many volumes of philological and historical controversy have been written.

1. It has been generally assumed and admitted that the modern Gael are a portion of the *Galli*, or Gauls, of antiquity, the people who gave its former name to the country now called France, and who were principally, though by no means exclusively, known to the Greeks and Romans as the inhabitants of that region. Although however this opinion has been commonly adopted, the grounds upon which it has been taken up do not appear to be very conclusive. They are principally the similarity of the two names—some historical and traditional testimony to the fact that South Britain was originally peopled from Gaul—some traces, rather faint and disputable, of identity of institutions and customs—and what would be the strongest argument, if it were well made out, the evidences of identity of language conceived to be established by the comparison of the names of places in France, and a few other remains of the old language spoken there, with the modern Gaelic of Scotland and Ireland. But the supposition is not unattended with difficulties, and if adopted it does not clear up the question of how the Gauls got either to Scotland or to Ireland.

2. Supposing the Gael to be the *Galli* of the Roman writers, and the Galatai (Γάλαται) of the Greeks, a question arises as to whether these names are the same with the *Celtæ* or *Celti*, or *Keltai* (Κελται), sometimes spoken of by the antients as a general name for the Gauls, sometimes as the name of only a certain portion of the Gauls. [Celtæ.] And if the *Gauls* and the *Celts* were distinct names, it remains to be settled which was the general name of the nation, and which the name only of the division or tribe. Several antient writers have represented the *Celts* to be the most antient name of the nation, and the *Gauls* to be a name substituted at a comparatively late period; but it has been contended in modern times on very plausible grounds that this notion is a mistake, and that the Celts were only a section of the Gauls, which was always the generic name.

3. Then there has been a world of controversy about the origin and meaning of both *Gael* and *Celt* (antiently, it is to be remembered, pronounced Kelt); the confusion here again being increased by the difference of opinion as to whether these are different words or only different forms of the same word. Of Gael, taken by itself and assumed to be different from Celt, it cannot be said that anything has been made; all the derivations suggested are puerile. On the assumption that it is the same with Celt, it has been found perhaps somewhat less intractable; but this cannot be received as a proof that that assumption is correct. The most probable account of Celt is that which connects it with the Gaelic *Caoill*, a wood—perhaps the same with the Greek *Kalon* (Κάλον) wood—whence *Caoiltich*, a people inhabiting a woody country. This is also the origin commonly assigned to the name *Caledonii*; which is supposed to be *Caoildaoine*, literally 'wood-people,' or people of the woods. The inquiry into the meaning of the word *Gael* has been greatly embarrassed by its similarity to another word still used in the Gaelic both of Scotland and Ireland, and which curiously enough seems to have the very opposite meaning to Gael. Thus, while the Scottish Highlanders call themselves Gael, they call all the rest of the Scotch, who do not speak Gaelic, by the name of *Gaoill*, or in the singular *Gaoll*, which they understand to mean strangers or foreigners. Thus *Gaolldoch* is the country of the Scots who speak English; *Gaeldoch*, the country of the Highlanders who speak Gaelic. In the same manner *Gall* is the Irish term for a stranger, or one speaking a different language; but it is very remarkable that this fact should have been advanced by Mr. Moore in his late 'History of Ireland' (i. 3) as a proof that the Irish do not consider themselves as being of Gaulish origin, while he must have known that they at the same time call themselves *Gael*—a fact however to which he has not, as far as we can find, adverted in any part of his work. Then, after all, comes to be considered the possible connection between either Gael or Gaoll and the *Wealh* of the Anglo-Saxons, whence our modern Welsh and Wales, and which seems to be the same with the Wälsh, applied generally to foreigners by the modern Germans. Were the Cymry called Wealh by the Saxons (whence the French have made *Galles*, as we have made *Welsh*) because they were considered to be Gael or Gauls, or because they were held to be strangers, foreigners, aliens?—or is it possible that the two words which appear in the modern Gaelic and Irish in the slightly distinguishable forms of Gael and Gaoll or Gall, notwithstanding their apparently opposite significations, may after all be only different forms of the same word?

4. The last class of disputed points we shall mention are those arising out of the history of the various nations and languages which are either Gaelic, or have by some been assumed to be Gaelic. What was the real amount of the connection or distinction between the antient Gauls and Germans? In what relation to either stood the Iberians? in what the Celtiberians? in what the Aquitanians? Were the Cimbri Gauls or Germans? Were the Belgæ Gauls or Germans? Whether or in what degree is the Gaelic tongue related to what have been called the Indo-Germanic languages? Is there any connection, and to what amount, between the Gaelic and the Semitic languages? These are the principal questions that have been agitated with regard to the Gael or supposed Gael of the antient world. Their modern history has afforded fully as many more. Was Britain originally peopled by a Gallic or Germanic race? Were the Picts Gauls or Germans? Were the Caledonians Gauls or Germans? Were the more recently-settled colonists whom Cæsar found in the South of Britain of Gallic or Germanic stock, and did they speak a Gaelic or Teutonic language? What is the degree of affinity between the Welsh tongue and that spoken by the native Irish and the Highlanders of Scotland? Is it a dialect of the same tongue, or (as has lately been strenuously maintained) a language of altogether a distinct family? Is the Basque a Celtic dialect? Whence came the Irish, supposing them to be Gael from India? or Persia? or Phœnicia? or Spain? or France? or England? or Scotland? Were the Scots or Milesians of Ireland a Gallic or Germanic people? What is the origin of the present Highlanders of Scotland? Are they the progeny of a comparatively recent Irish colonization, as has of late been generally agreed, and as their own traditions have always asserted? or are they the descendants of the antient Caledonians, assumed on that supposition to be Gauls, and to have been the original population of the whole island, who were, probably a short time before the commencement of the Christian æra, driven from South to North Britain before a new immigration from the continent? All or most of these may be considered as questions still doubtful and disputed.

It would occupy much more space than we can afford to enumerate even the more important works in which these various controverted points have been discussed in our own and other languages. We shall only mention that the most recent publication which has appeared on the subject of the Gael in English is 'The Highlanders of Scotland, their Origin, History, and Antiquities,' by W. F. Skene, 2 vols. 8vo. London, 1837, being an essay to which a prize had been awarded by the Highland Society of London. Mr. Skene's views and reasonings are of very considerable ingenuity as well as novelty; but whatever may be thought of the part of it which relates to the origin of the Gael, the work is undoubtedly in other respects one of the most important contributions to early Scottish history that modern research has furnished.

GAE'TA, a strongly fortified town and a bishop's see in the province of Terra di Lavoro in the kingdom of Naples, is situated on a lofty promontory which projects into the Mediterranean, and forms one side of the gulf of the same name, the antient Sinus Formianus, which almost rivals in beauty of scenery the neighbouring Bay of Naples. The islands of Ponza, Vandotena, and Ischia are seen at a distance. Inland to the northwards, the Apennines rise above the wide unwholesome plains extending to the sea-coast: through these plains flows the Garigliano, or Liris, near the mouth of which stood the antient Minturnæ, of which few traces remain except some arches of its aqueduct. In the immediate neighbourhood of Gaeta the Formian hills are covered with vineyards, olives, oranges, and other fruit-trees, and at the foot of them, in the innermost recess of the gulf, is Mola, near the site of the antient Formiæ, which was destroyed by the Saracens in the ninth century. Cicero's Formianum was in this neighbourhood, about half-way between Mola and Gaeta, at a place called Castellone ('Antichitá Ciceroniane ed Iscrizione esistenti nella villa Formiana in Castellone di Gaeta,' by the Prince of Caposele, Naples, 1827, with plates). The monument near Mola, which is vulgarly called Torre di Cicerone, is not the tomb of the orator.

Gaeta with its suburbs has a population of about 10,000 inhabitants, exclusive of the garrison. It has sustained several sieges, the last of which was in 1806 against the French. It has a harbour, and carries on some trade by sea. Caieta, which appears to have been an old Greek colony, was not a place of great importance under the Romans: it has however some remains of antiquity, among others the circular monument called Torre di Orlando, which is the mausoleum of L. Munatius Plancus, a friend of Augustus; and another tower, called Latratina, which was once part of a temple. In the cathedral is a baptismal vase of Parian marble with highly finished rilievos, besides other remains. Gaeta is the head town of a district which extends from the Garigliano to the frontier of Rome. [TERRA DI LAVORO.]

GAFFURIUS. [GAFORIUS.]

GAFO'RIUS, FRANCHI'NUS, or FRANCHINO GAFORI, a very learned writer on music, was born of humble parents, at Lodi, in 1451. In his boyhood he was devoted to the service of the church, and among other branches of knowledge to which he applied himself with marked diligence, he studied music under a Carmelite friar named Godendach, of which science, both theoretically and practically, he became a complete master. It does not seem certain that the sacerdotal dignity was ever conferred on him, though it has been confidently stated that he entered into holy orders. He first went to Verona, publicly taught music there during some few years, and also wrote his work, *Musicæ Institutiones Collocutiones*. The reputation he thereby acquired, procured him an invitation from the Doge to visit Genoa, which he accepted, but soon after proceeded to Naples, where he met Tinctor, Garnerius, Hycart, and other celebrated musicians, and, according to the usage of the time, held public disputations with them. At Naples he also produced his *Theoricum Opus Harmonicæ Disciplinæ*. But the Turks having brought war and the plague into the Neapolitan territory, he was driven from that part of Italy, and by the persuasion of Pallavicini, bishop of Monticello, returned to Lodi, gave lectures on music, and began his *Practica Musicæ utriusque Cantus*, his greatest work, which was first printed at Milan in 1496. Of this, Sir J. Hawkins has given a copious abstract, an honour to which it was entitled, not only on account of it intrinsic merit, but because it is the first treatise on the ar that ever appeared in print. It is full of that kind of information which was called for, and proved eminently useful at the period in which it was published, quickly spreading the author's fame throughout Europe. But, touched by the pedantic spirit of the age, he invented terms that must have cost him infinite labour to compound, and which doubtless exacted no less from his readers before they could understand them. His work lying before us, we are tempted to give a specimen of the language of art adopted in the fifteenth century, as it appears in the heading of one of his chapters: *De Proportione Subquadruplasupertripartientiquarta.*

Gaforius (erroneously called Gaffurius by Hawkins, Burney, &c.) wrote other works, which were held in high estimation. It is supposed that he died in or about the year 1520.

GAGE, any apparatus for measuring the state of a phenomenon. But the term is usually restricted to some particular instruments, such as the gage of the air-pump, which points out the degree of exhaustion in the receiver, the wind-gage [ANEMOMETER], the tide-gage, &c., &c., all of which are mentioned in connexion with their several subjects.

GAHNITE, a mineral so called from the name of its discoverer, Gahn; it is sometimes also called automalite and zinciferous spinel. It occurs crystallized in regular octohedrons and varieties. Sp. gr. from 4·1 to 4·8. Hardness 8. It is of a dark bluish-green colour, nearly opaque; may be cleaved parallel to all its planes. Before the blowpipe it is unalterable alone, and nearly so with fluxes.

It occurs at Fahlun, in Sweden, and Franklin, in America; both varieties have been analyzed by Abich, with the annexed results:—

	Sweden.	America.
Alumina . . .	55·14	57·09
Silica	3·84	1·22
Magnesia . . .	5·25	2·22
Oxide of Zinc . .	30·02	34·80
,, Iron . .	5·85	4·55
	100·1	99·88

GAIL, JEAN BAPTISTE, born at Paris in 1753, distinguished himself in the study of Greek, and was made, in 1791, Professor of Greek Literature in the College de France. In 1794 he married Mademoiselle Sophie Garre, who afterwards became celebrated as a musical composer. Her husband has written a number of works, chiefly translations from the Greek; a Greek grammar, 1799, with a supplement, or 'Essai sur les Prépositions Grecques considérées sous le rapport Géographique,' 1821; and 'Cours de Langue Grecque, ou Extraits de differens Auteurs,' in four parts, 1797-99. He wrote also 'Observations sur les Idylles de Théocrite et les Eclogues de Virgile,' 1805; and lastly he furnished the materials for the 'Atlas contenant par ordre de temps, les Cartes rélatives à la Géographie d'Herodote, Thucydide, Xenophon, les plans de bataille,' &c., 4to. Paris; to which are added 'Observations Préliminaires,' and an Index, by Gail. Gail was made Knight of the Legion of Honour by Louis XVIII., and Knight of St. Wladimir by the Emperor Alexander.

GAILLAC. [TARN.]

GAILLARD, GABRIEL HENRI, a celebrated modern French historian, was born in 1726. After receiving a good education, he was admitted advocate at an early age, but he soon left the bar in order to devote himself entirely to literature. In 1745, when he was only 19 years old, he wrote a treatise on rhetoric for the use of young ladies. In 1757 he published the History of Mary of Burgundy, daughter of Charles the Bold and wife of the Emperor Maximilian I. This work had great success. In 17[illegible] was published his 'History of Francis I. of France.' It is the general opinion that he did full justice to this subject, though he presented it in a rather uninviting form for the generality of readers, having divided the history of that celebrated reign into separate parts, such as civil, political, military, ecclesiastical, and literary history, the private life of the king, &c. The author adopted the same plan in his 'History of Charlemagne,' 1782, in 4 vols. 4to. Besides the objection to his mode of dividing the subject-matter, it was further objected to the 'History of Charlemagne' that he had sunk the biography of his hero between two long dissertations on the first and second races of the French kings. Notwithstanding these defects, the work met with great success, and received the praises of Gibbon and of

the celebrated German historian Hegewisch, who himself wrote a history of Charlemagne in German. The best work of Gaillard is his 'History of the Rivalry between France and England,' of which the first three volumes appeared in 1771, the four following in 1774, and the four concluding volumes in 1777. This work embraces not only the political and military relations between the two countries, but also the internal history of both, so arranged as to present a constant parallelism. His 'History of the Rivalry between France and Spain,' 8 vols. in 12mo., a work highly appreciated in France, is written on the same plan. Gaillard was the author of the 'Historical Dictionary' in the 'Encyclopédie Méthodique,' 6 vols. in 4to., and many other minor works, the most valuable of which are a 'Life of Malesherbes,' his personal friend, 1805, 1 vol. 8vo.; and 'Observations on the History of France,' by Velly, Villaret, and Garnier, 4 vols. 12mo, 1806. Gaillard died in 1806, in consequence of his severe application. His moral character stood very high.

GAINSBOROUGH, an antient market-town and parish situated on the eastern bank of the Trent, in the county of Lincoln, 149 miles N. by W. from London. Gainsborough is noted as being the place where the Danes anchored at the period when the surrounding country was devastated by their sanguinary tyrant Sweyne, and where he was stabbed by an unknown hand when on the point of re-embarking. It is also the birth-place of Simon Patrick, the learned and pious bishop of Ely, who died in 1707. The town is well paved and lighted, and consists principally of one street running parallel to the river, which is here crossed by a fine stone bridge of three elliptical arches. The townhall, wherein the sessions were formerly held, is a substantial brick building, beneath which is the gaol. The living is a vicarage in the diocese of Lincoln, and in the patronage of the bishop of that see, with an annual net income of 529*l.* Gainsborough is advantageously situated both for foreign and inland trade. By means of the Trent, which falls into the Humber about 20 miles below the town, vessels of 200 tons are enabled to come up to the wharfs, and by the Readley, Chesterfield, and other canals a communication is kept up with the interior of the country. The market-day is Tuesday, and the fairs for cattle, &c. are held on Easter-Tuesday and the 20th of October. In 1831 the entire parish, including the hamlets of Morton, East Stockwith, and Walkerith, contained 7535 inhabitants. There is a charity school at which the children of the poor are taught reading, writing, and the elements of arithmetic.

GAINSBOROUGH, THOMAS, born in 1727, at Sudbury, in Suffolk, was one of the most eminent English landscape painters of the last century. His father being a person in narrow circumstances, the education which his son received was very scanty; and it is probable enough that in his boyish days he passed much less time at school than in the woods of Suffolk, where he acquired that relish for the beauties of quiet nature and that intimate acquaintance with them for which his early pictures are so peculiarly distinguished. Having almost from his childhood amused himself with sketching any object that struck his fancy, an old tree, a group of cattle, a shepherd and his dog, &c., he ventured on colouring, and had painted several landscapes before he was twelve years of age, when he was sent to London. There he was for some time with Mr. Gravelot, the engraver, and Hayman, the painter, with whom he did not remain long, but setting up as a portrait-painter, supported himself, till, at the age of nineteen, he married a young lady who had a fortune of 200*l.* per annum. On his marriage he went to Ipswich, where he resided till 1758, when he removed to Bath. Having practised portrait-painting with increasing success, he removed in 1774 to London; and having painted portraits of some of the royal family, which were much admired, he soon acquired extensive practice and proportionate emolument. But though his portraits were much valued at the time as striking likenesses, this was too frequently their only merit: they were often painted in a rough careless manner, in a style of hatching and scumbling entirely his own, producing indeed an effect at a distance, but undetermined and indistinct when viewed near. At times he would take more pains, and show what he could do. But Gainsborough, in fact, considered this loose manner as peculiarly excellent, and was desirous that his pictures in the Exhibition might be so hung as to be within reach of close inspection. With painters his fame rests on his landscapes, and what might be called fancy-pieces, such as the celebrated 'Cottage Door,' now in the collection of the Marquis of Westminster. There is however a wonderful difference between his early and his later performances. In the former every feature is copied from nature in its greatest detail, and yet without stiffness; so that they look like nature itself reflected in a convex mirror. In his latter works striking effect, great breadth, and judicious distribution of light and shade, produce a grand and even a solemn impression. Both have their admirers, as tastes differ; but though he may not deserve to be ranked as some would have him, with Vandyck, Rubens, and Claude, in portrait and in landscape, all will assent to the opinion of Sir Joshua Reynolds—'that if ever this nation should produce genius sufficient to acquire to us the honourable distinction of an English school, the name of Gainsborough will be transmitted to posterity as one of the very first of that rising name.'

Gainsborough died of a cancer in the neck, in August, 1788, in the sixty-first year of his age.

GAIUS, or CAIUS, one of the Roman classical jurists whose works entitle him to a place among the great writers on law, such as Papinian, Paulus, and Ulpian. Nothing is known of the personal history of Gaius beyond the probable fact that he wrote under Antoninus Pius and Aurelius. His works were largely used in the compilation of the 'Digest,' or 'Pandect,' which contains extracts from the writings of Gaius under the following titles:—'Res Cottidianæ sive Aureorum,' (Dig. xl. 9, 10, &c.); 'De Casibus,' (xii. 6, 63, &c.); 'Ad Edictum Ædilium Curulium,' (xxi. 1, 18, &c.); 'Liber ad Edictum Prætoris Urbani,' xl. 12, 6, &c.); 'Ad Edictum Provinciale,' (xiv. 4, 9, &c.), which consisted of thirty books at least; 'Fidei Commissorum,' (xxxii. 1, 14, &c.); 'Formula Hypothecaria,' (xx. 1, 4, &c.); 'Institutiones,' (i. 6, 1, &c.); 'De Verborum Obligationibus,' (xlvi. 1, 70). There are also extracts from several other works of Gaius in the 'Pandect.'

The 'Institutions' of Gaius were probably the earliest attempt to present a sketch of the Roman law in the form of an elementary text-book. This work continued in general use till the compilation of the 'Institutions' which bear the name of Justinian, and which were not only mainly based on the 'Institutions' of Gaius, but, like this earlier work, were divided into four books, with the same general distribution of the subject matter as that adopted by Gaius.

The 'Institutions' of Gaius appear to have been neglected after the promulgation of Justinian's compilation, and were finally lost. All that remained was the detached pieces collected in the 'Digest,' and what could be gathered from the 'Breviarium Alaricianum,' as the code of the Visigoths is sometimes called. But in 1816, Niebuhr discovered a MS. in the library of the chapter of Verona, which he ascertained to be a treatise on Roman law, and which Savigny, founding his opinion on the specimen published by Niebuhr, conjectured to be the 'Institutions' of Gaius.

This conjecture of Savigny was soon fully confirmed, though the MS. has no author's name on it. Goeschen, Bekker, and Hollweg undertook to examine and copy this MS., an edition of which appeared at Berlin in 1820, edited by Goeschen. To form some idea of the labour necessary to decipher this MS., and of the patient perseverance of the scholars who undertook this formidable task, the reader must refer to the report of Goeschen to the Academy of Berlin, November 6, 1817. The MS. consists of one hundred and twenty-seven sheets of parchment, the original writing on which was the four books of the 'Institutions' of Gaius. This original writing had on some pages been washed out, so far as was practicable, and on others scratched out; and the whole, with the exception of two sheets, had been re-written with the epistles of St. Jerome. The lines of the original and of the substituted writing run in the same direction, and often cover one another; a circumstance which considerably increased the difficulty of deciphering the text of Gaius. In addition to this, sixty-three pages had been written on three times: the first writing was the text of Gaius, which had been erased; and the second, which was a theological work, had shared the same fate, to make room for the epistles of St. Jerome.

A second examination of this MS. was made by Bluhme (*Præfatio Novæ Editionis*), and a new edition of the 'Institutions' was published by Goeschen, at Berlin, in 1824, which presents us with an exact copy of the MS. with all its deficiencies, and contains a most copious list of the abbreviations used by the copyist of Gaius.

The discovery of a work, the loss of which had so long been regretted, produced a most lively sensation among continental jurists, and called forth a great number of essays. In England it has yet attracted little attention beyond a superficial notice in the 'Edinburgh Review' (vol. xlviii., p. 385), and an occasional allusion to it elsewhere, though it is undoubtedly one of the most valuable additions that have been made in modern times to our knowledge of Roman Law. The fourth book of the 'Institutions' is particularly useful for the information which it contains on actions and the forms of procedure. The style of Gaius, like that of all the classical Roman jurists, is perspicuous and yet concise.

One of the most useful editions of Gaius is that by Klenze and Böcking (Berlin, 1029), which contains the 'Institutions' of Gaius and Justinian, so arranged as to present a parallelism, and to furnish a proof, if any were yet wanting, that the MS. of Verona is the genuine work of Gaius.

In addition to the references already made, the reader may consult an ingenious essay by Goeschen on the 'Res Quotidianæ,' of Gaius (*Zeitschrift für Geschichtliche Rechtswissenschaft*, Berlin, 1815); Hugo, 'Lehrbuch der Geschichte des Römischen Rechts;' Dupont, 'Disquisit. in Commentarium iv. Instit. Gaii,' &c., Lugd. Bat. 1822.

GALACZ. [MOLDAVIA.]

GALA'GO. [LEMURIDÆ.]

GALANGA, or GALANGAL, is usually supposed to have been introduced by the Arabs, but it was previously mentioned by Ætius. The Arabs call it *Kholingan*, which appears to be derived from the Hindu *Koolinjan*, or Sanscrit *Koolunjuna*, indicating the country whence they derived the root, as well as the people from whom they obtained their information respecting its uses. The plant which yielded this root was long unknown, and it was supposed to be that of a pepper, of an iris, of Acorus Calamus, or to be the Acorus of the antients. Kæmpferia Galanga was so called from its aromatic roots being supposed to be the true Galangal. The tubers of *Cyperus longus* were sometimes substituted, and called *English Galangal*. Two kinds, the large and the small galangal, are described; these are usually considered to be derived from the same plant at different stages of its growth, but Dr. Ainslie, in his 'Materia Indica,' insists upon the greater value of the lesser, as this is warmer and more fragrant, and therefore highly prized in India. It is a native of China, and the plant producing it is unknown. Dr. Ainslie does not prove that it is the Galanga minor of Europe.

The greater Galangal has long been known to be the produce of a Scitamineous plant, the Galanga major of Rumphius (*Herb. Amb.* 5. t. 63), which is the *Alpinia Galanga* of Wildenow, and a native of China and the Malayan Archipelago. It is fully described by Dr. Roxburgh, in his *Flora Indica*, vol. i. p. 28, ed. Wall. The roots, perennial and tuberous, like those of the ginger, were ascertained by Sir Joseph Banks and Dr. Comb to be identical with the Galanga major of the shops. This is cylindrical, often forked, thick as the thumb, reddish brown externally, marked with whitish circular rings, internally lighter coloured, of an agreeable aromatic smell, and a hot spicy taste, like a mixture of pepper and ginger, with some bitterness. The stem is perennial, or at least more durable than those of herbaceous plants; when in flower, about six or seven feet in length; its lower half invested by leafless sheaths. The leaves are two-ranked, lanceolar, from twelve to twenty-four inches long, and from four to six broad. Panicle terminal, crowned with numerous branches, each supporting from two to five pale greenish-white and somewhat fragrant flowers in April and May in Calcutta, where the seeds ripen, though rarely, in November.

Several species of this genus have roots with somewhat similar properties. Thus Alpinia alba and Chinensis are much used by the Malays and Chinese; the former has hence been called Galanga alba of Kœnig; and the latter has an aromatic root with an acrid burning flavour. The fragrant root of *A. nutans* is sometimes brought to England, according to Dr. Roxburgh, for Galanga major. Its leaves, when bruised, have a strong smell of cardamums, and the Cardamomum plant is frequently placed in this genus, but has been described under ELETTARIA.

GALANTHUS, a genus of Amaryllidaceous plants consisting of the Snowdrop and another species. The former plant is a native of subalpine woods in various parts of Europe; the second, which is the G. plicatus of botanists, inhabits the Asiatic provinces of the Russian and Turkish empires.

GALAPAGOS are a group of islands in the Pacific, about 700 miles from the continent of South America, near the equator. They lie between 1° N. lat. and 2° S. lat., and between 89° and 92° W. long., and consist of six larger and seven smaller islands. The largest is Albemarle Island, which is 60 miles in length, and about 15 broad. The highest part is 4000 feet above the sea. Charles Island, now called La Floriana, is 20 miles long from north to south, and about 15 miles wide.

There are few islands in the world whose volcanic origin is more incontestable than that of the Galapagos. They consist of enormous masses of lava, rising abruptly from a fathomless sea. Along the shores nothing but black dismal-looking heaps of broken lava meet the eye; but in the interior, valleys and plains of moderate extent occur, which are covered with shrubs and that kind of cactus which is called prickly pear. This cactus supplies with food the land tortoises, which are called the great elephant-tortoises, their feet being like those of a small elephant. These animals grow to an enormous size, and frequently weigh 300 or 400 pounds. There are also iguanas and innumerable crabs. Pigeons also abound.

The climate is not so hot as would be expected from the geographical position of the islands, which is partly to be ascribed to the elevation of their surface (the settlement on La Floriana being 1000 feet above the level of the sea), and partly to the cold current which sets along the south-south-western side of the group to the north-north-west. The dry season occurs in our summer, when most of the water-pools dry up; but at the setting-in of the rains, in November, they are again filled. Between May and December the thermometer ranges between 52° and 74°, and from January to May between 74° and 84°. Captain Hall found that it rose to 93°, but this may have been the effect of local circumstances.

These islands were long considered as sterile rocks, and were first visited towards the end of the last century by the whalers of the Pacific Ocean, especially for the elephant-tortoises, which were caught in great number, and served the crews for fresh provisions. In 1832 a settlement was formed by one Bilamil, an inhabitant of Guayaquil, who obtained a grant of the island of La Floriana from the government of Ecuador. The inhabitants cultivate bananas, sugar-cane, sweet potatoes, and Indian corn in such quantities, that they can provide with these articles the whalers, who frequently resort to the island. (Captain Basil Hall's *Extracts from a Journal*, &c.; *London Geographical Journal*, vol. vi.; Reynolds's *Voyage of the U. S. frigate Potomac*, &c.)

GALATHE'A (Zoology), GALATHEA-TRIBE, GALATHEIDÆ, a group of Crustaceans corresponding with the genus *Galathea* of Fabricius, and establishing, in the opinion of M. Milne Edwards, a passage between the Anomurous and Macrurous Crustaceans, being more particularly approximated to the *Porcellanæ*. [PORCELLANIDÆ.] Dr. Leach divided the genus established by Fabricius into four: viz. the true *Galatheæ*, *Munidea*, *Grimothea*, and *Æglea*. M. Milne Edwards thinks that three of these genera should be preserved, but agrees with M. Desmarest in coming to the conclusion that the genus *Munidea* has not sufficient characteristics to admit of its adoption in a natural classification. With regard to *Æglea*, M. Milne Edwards considers it as approximating more to the *Porcellanæ* than to the *Galatheæ*, and as occupying a place in the section of the *Anomura*.

The *Galatheidæ*, then, according to the revision of M. Milne Edwards, are thus distinguished. *Carapace* depressed and wide, but still longer than its width, terminating anteriorly by a *rostrum* more or less projecting, which covers the place of the ocular peduncles, and presents on its upper surface many furrows or wrinkles, among which, one deeper than the rest defines the posterior part of the stomachic region. *Antennæ* inserted on the same transversal line; internal antennæ but little elongated, placed under the ocular peduncles, and terminated by two small, multiarticulate, very short filaments; external antennæ with no trace of palpiform appendages at their base, but with a cylindrical peduncle and a long and slender terminal filament. *External Jaw-feet* (pates-mâchoires) always pediform, but varying a little in their conformation. *Sternal plate* (plastron sternal) widening a good deal posteriorly,

and the last thoracic ring ordinarily distinct. Anterior *feet* large and terminated by a well formed claw; those of the three following pairs of limbs rather stout, and terminated by a conical tarsus; fifth pair very slender, and folded above the others in the branchial cavity; these last do not assist the locomotion, and are terminated by a rudimentary hand. *Abdomen* nearly as wide as the thorax, and longer, vaulted above and armed on each side with a row of four or five large teeth formed by the lateral angle of the superior arch of the different rings composing it, and terminated, as in the greater part of the Macrurous Crustaceans, with a large fan-shaped lamelliform fin. The number of abdominal *false feet* varies; in the male there are five pairs, the two first of which are slender and elongated, and the three last are terminated by an oval lamina ciliated on the edge: in the female, the first abdominal ring is without appendages, but the four following segments have each a pair of false feet composed of three joints placed end to end and fringed with hairs for the attachment of the eggs.

Genera. Galathea.

Generic Character.—The whole surface of the *Carapace* covered with transverse furrows fringed with small brush-like hairs. Hepatic regions, in general, well distinguished from the branchial, and occupying with the stomachic region nearly half of the space of the Carapace. *Rostrum* projecting and spiny; *eyes* large and directed downwards; no trace of an orbit. A spine above the insertion of the external antennæ, and two others on the anterior part of the stomachic region. Basilary joint of the *internal antennæ* cylindrical and armed at its anterior extremity with many strong spines; the two following joints slender and nearly as long as the first. Peduncle of the *external antennæ* composed of three small cylindrical joints, the last of which is much smaller than the others. *External Jaw-feet* moderate, the two last joints neither foliaceous nor even enlarged. Anterior feet long and depressed. (Milne Edwards.)

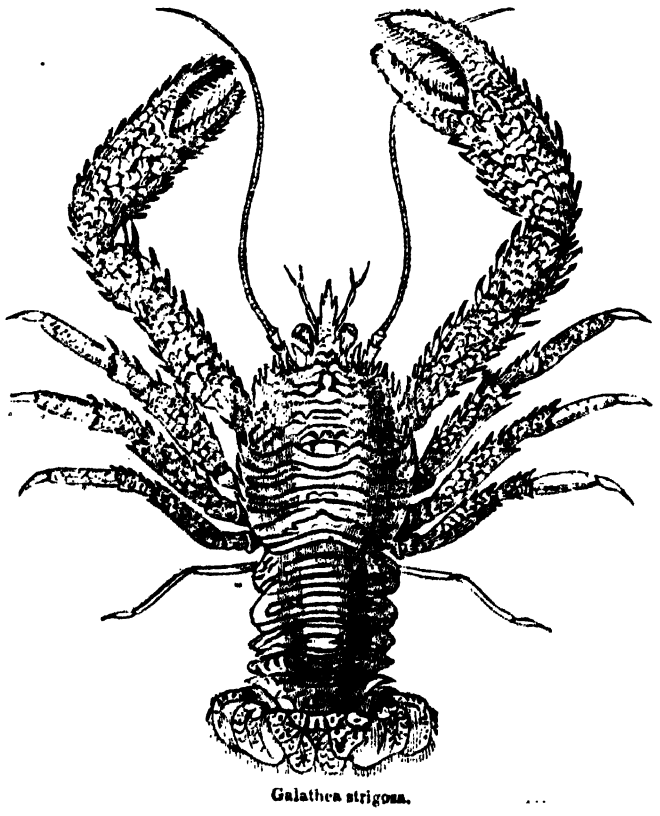
*

Species whose external jaw-feet present a row of teeth on the internal edge of their second joint.

α

Third joint of the external jaw-feet shorter than the second.

Example, *Galathea strigosa*; *Galathea spinigera*, Leach; *Cancer strigosus*, Linn. Description.—Rostrum triangular and armed with seven strong projecting spiniform teeth. Lateral edges of the carapace with strong spiniform teeth.



Galathea strigosa.

Three long spines at the anterior extremity of the first joint of the external antennæ; a great spine under the auditory tubercle, two smaller ones on the first joint of the external antennæ, and one on their second joint. External jaw-feet short, hardly overpassing the rostrum when they are extended, their third joint much shorter than the second, and armed beneath with two strong spines. Anterior feet long, depressed, and very spiny; the hand very large, edged with spines and ornamented above with small piliferous furrows resembling imbricated scales, claws short, large and with a spoon-shaped termination. Feet of the second and third pair of the same length. Abdomen furrowed transversely, but without a spine; the seventh segment a little widened and rather narrower behind than before. Colour reddish, with some blue lines on the carapace. Length about five inches *Locality*, the Mediterranean and the Ocean.

β

Third joint of the external jaw-feet much longer than the second.

Example, *Galathea squamifera*. Locality, the coasts of England and France.

* *

Species whose external jaw-feet have no dentilation on the internal edge of their second joint.

Example, *Galathea Monodon*. Locality, the coasts of Chile.

Grimothea.

Differing but little from *Galathea*, and hardly sufficiently distinct for separation. General form of both essentially the same, but the basilary joint of their internal antennæ is claviform and hardly dentated at its extremity, and the external jaw-feet are very long and have their three last joints enlarged and foliaceous. (Milne Edwards.)

Example, *Grimothea gregaria*.

M. Milne Edwards observes that the Crustacean figured by M. Guérin under the name of *Grimothée sociale* ('Voyage of La Coquille:' Crust., pl. 3. fig. 1) differs from *G. gregaria* in the form of the caudal fin, the middle lamina of which is less than the lateral ones. M. Edwards proposes therefore to name it *Grimothea Duperreii* in honour of the navigator whose voyage made the species known.

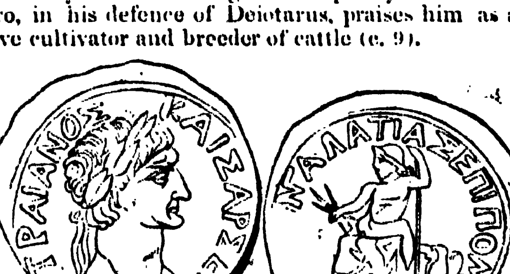
N.B. The student should bear in mind that the term *Galathea* was employed by Bruguières (who died in 1799) to distinguish a genus of Conchifers which M. Rang thinks might as well perhaps be united to *Cyrena*.

M. Desmarest is of opinion that M. Risso's genus *Calypso*, afterwards, according to M. Desmarest, named by M. Risso *Janira* (a designation allotted by Dr. Leach to a genus of *Isopoda*), approximates closely to *Galathea*.

GALATIA, a country of Asia Minor, which originally formed part of Phrygia and Cappadocia. It is difficult to determine its exact boundaries, as they differed at various times. It was bounded on the south by Phrygia and Cappadocia, on the east by Pontus, on the north by Paphlagonia, and on the west by Bithynia. It obtained the name of Galatia from the settlement of a large body of Gauls in this part of Asia. The first horde that appeared in Asia (B.C. 279) formed part of the army with which Brennus invaded Greece. In consequence of some dissensions in the army of Brennus, a considerable number of his troops, under the command of Leonorius and Lutarius, left their countrymen and marched into Thrace; thence they proceeded to Byzantium, and crossed over into Asia at the invitation of Nicomedes king of Bithynia, who was anxious to secure their assistance against his brother Ziboetas. (Livy, xxxviii. 16.) With their aid Nicomedes was successful; but his allies now became his masters, and he, as well as the other monarchs of Asia Minor to the west of Mount Taurus, was exposed for many years to the ravages of these barbarians, and obliged to purchase safety by the payment of tribute. Encouraged by the success of their countrymen, fresh hordes passed over into Asia, and their numbers became so great that Justin informs us (xxv. 2) "that all Asia swarmed with them; and that no Eastern monarchs carried on war without a mercenary army of Gauls." In conformity with this statement, we read of their assisting Ariobarzanes and Mithridates, kings of Pontus (about B.C. 266), against Ptolemy king of Egypt (Clinton's *Fasti Hellenici*, vol. iii. p. 424), and of their supporting Antiochus Hierax in his ambitious wars against his brother Seleucus Callinicus (Seleucus reigned B.C. 246-226). They are also said in the second book of Maccabees (viii. 20) to have advanced as far as Babylon, and

to have been defeated by the Jews. The first check they eceived was from Attalus I. king of Pergamus, who defeated them in a great battle (B.C. 239) and compelled them to settle permanently in that part of Asia which was afterwards called Galatia. (Livy, xxxiii. 21; Polybius, xviii. 24.) Before this time they appear to have had no fixed habitations, but to have wandered over the various provinces of Asia Minor in search of plunder, and to have had the command of the sea-coasts of Bithynia and Paphlagonia; since Pausanias states (i. 18, s. 2) that Attalus forced them to retire from the sea to the country which they inhabited in his time. Though Attalus reduced their power, they still remained independent, and gave Antiochus great assistance in his contest with the Romans. Having thus incurred the enmity of the Roman republic, Cn. Manlius the consul was sent against them with a considerable army, B.C. 189. The particulars of this war, which terminated in the complete defeat of the Galatians, are recorded in Livy (xxxviii. 12-27). From this time they were in reality subject to Rome, though allowed to retain their own native princes. In the war against Mithridates, Deiotarus, originally only a tetrarch of one of the Galatian tribes, greatly assisted the Romans, for which service he was rewarded by the grant of Pontus and Little Armenia, and the title of king by the Roman Senate. [DEIOTARUS.] He was succeeded by Amyntas, according to Strabo (b. xiii.), or by Castor according to Dio (l. xlviii.). At the death of this prince, B.C. 25, Galatia became a Roman province. After the time of Augustus, the boundaries of the province were enlarged, and Paphlagonia was added to it; but in the reign of Constantine it was again reduced to its former limits; and in the time of Theodosius the Great was subdivided into two provinces, *Galatia prima* and *Galatia secunda*, of which Ancyra was the capital of the former, and Pessinus of the latter.

Strabo (b. xii.) informs us that Galatia was inhabited by three tribes of Gauls: the Trocmi, the Tectosages, and the Tolistobogii. Pliny (*Nat. Hist.* v. 42) mentions four tribes: Trocmi, Tectosages, Voturi, and Ambitui. Mannert (*Géographie*, vol. iii., part iii., p. 43) supposes with great probability that Pliny has by mistake given us the names of two of the smaller divisions, especially as he mentions incidentally in the same chapter the name of the Tectosages. Each tribe was subdivided into four parts, and each tribe was governed by a tetrarch, who appointed a judge and an inspector of the army. The power of these twelve tetrarchs was limited by a senate of 300, who assembled at a place called Drynæmetum, and who took cognizance of all capital cases. All other offences were left to the jurisdiction of the tetrarchs and judges. This form of government continued till shortly before the time of Deiotarus. All the tribes spoke the same language, and had the same customs. Though they afterwards spoke Greek in common with the other nations of Asia Minor, yet they had not forgotten their native tongue in the time of Jerome, who informs us (*Prolegomena in Epis. ad Galatas*) that they then spoke the same language as the Treviri. They did not entirely lose their original simplicity of manners, for Cicero, in his defence of Deiotarus, praises him as an extensive cultivator and breeder of cattle (c. 9).



Coin of Galatia, Trajan. Imperial Greek.
British Museum. Actual size. Copper. Weight, 427 grains.

Galatia possessed few towns of importance, with the exception of ANCYRA, Tavium, and Pessinus. Tavium, the capital of the Trocmi, was situate in the north-east part of the province, but soon fell into obscurity. Pessinus, the capital of the Tolistobogii, north-east of the river Sangarius, was a great trading place, with a magnificent temple, sacred to the mother of the gods, who was there worshipped under the name of Agdistis. (Strabo, b. xii.) Pausanias mentions this temple, and also adds that the inhabitants of this town abstained from pork, for which custom he assigns a curious reason (vii. 17). On the river Sangarius in this province was the ancient Gordium, formerly the capital of the Phrygian monarchy, but which had become in the time of Strabo little better than a village. Livy (xxxviii. 18) describes Gordium as a small town in his time, but carrying on an extensive commerce.

Galatia was also called Gallo-Græcia, and its inhabitants Gallo-Græci, from the intermixture of the customs and languages of the Gauls and Greeks in this province.

GALATIANS, ST. PAUL'S EPISTLE TO THE, one of the canonical books of the New Testament. Its authenticity has never been doubted: it was frequently cited by the apostolical and succeeding fathers (Lardner's *Credibility of the Gosp. History*, vol. ii.), and was even admitted by Marcion to a place among the apostolical writings. The date of this epistle is much disputed, some critics supposing it to have been written as early as A.D. 48, and others as late as 58. Two journeys of St. Paul to Galatia are mentioned in the Acts; one in A.D. 50 (Acts xvi. 6); and the other in 55 (Acts xviii. 23). It must have been written shortly after one of these visits, since St. Paul complains (i. 6) 'that they were so *soon* removed from him that called them into the gospel of Christ unto another gospel.' As there is very slight evidence of his having visited Galatia a second time before he wrote this epistle, we may fix the date at A.D. 51 or 52. Hug argues in his 'Introduction' (vol. ii. p. 362, Eng. trans.), that the words, 'Ye know how through infirmity of the flesh I preached the gospel unto you *at the first* (τὸ πρότερον)' (iv. 13), prove that the apostle had visited them twice; in which case we must suppose the Epistle to have been written A.D. 56 or 57. It is stated at the conclusion to have been written from Rome, but this is evidently incorrect.

It appears that shortly after St. Paul had left Galatia, some Judaizing teachers had effected a great change in the churches of that country by teaching the Gentile converts that it was necessary for them to observe the ceremonial law, and submit to the rite of circumcision. They alleged that the other apostles taught this doctrine, and that St. Paul alone differed from them. They argued that the Galatians ought not to rely upon the authority of St. Paul, since he was not an apostle. These individuals were so successful that some of the Galatians appeared to have submitted to circumcision. To counteract these errors St. Paul wrote this epistle, in which he maintains that the authority of the other apostles could not be quoted as superior to his own, since he had received his apostleship from Christ himself, and had on this very subject 'withstood Peter to the face, because he was to be blamed.' (i. ii.) After thus vindicating his apostolical dignity, he argues in the remaining part of the epistle that the law had only been intended as a preparation for Christianity, as a 'schoolmaster to bring men unto Christ, that they might be justified by faith,' and that those who considered the observance of the Jewish law as necessary for salvation deprived themselves of the blessings of the Gospel. He concludes by exhorting them not to use the liberty which the Gospel gave them 'for an occasion to the flesh, but by love to serve one another.' On the undesigned coincidences with the 'Acts,' see Paley's *Horæ Paulinæ*, p. 135-183. (A list of commentators on this epistle is given in Watt's *Biblioth. Britannica*, and in Seiler's *Biblical Hermeneutics*, by Dr. Wright, p. 531. See Michaelis's *Introduction*, vol. iv. p. 8-22; Hug's *Introduction*, vol. ii. p. 361-366; Horne's *Introduction*, vol. iv. p. 369-372.)

GALAXAURA. [PSEUDOZOARIA.]

GALAXY. [MILKY WAY.]

GALBA, SE'RVIUS SU'LPITIUS, born under the reign of Augustus, of a patrician family, served with distinction in Germany, was afterwards proconsul, first in Africa, and afterwards in the Tarraconensis province of Spain, in which office he acquired a reputation for justice and moderation. He was still in Spain when Julius Vindex, the proconsul of Celtic Gaul, rose against Nero: Galba joined Vindex, and Otho, governor of Lusitania, followed his example. The assembled multitudes saluted Galba as emperor and Augustus, but he declared that he was only acting as the lieutenant of the senate and people of Rome, in order to put an end to the disgraceful tyranny of Nero. The Prætorian guards at Rome soon after having revolted against Nero, proclaimed Galba, and the senate acknowledged him as emperor. Galba hastened from Spain to Rome, where he

began by calling to account those favourites of Nero who had enriched themselves by proscriptions and confiscations, and by the senseless prodigality of that prince; but it was found that most of them had already dissipated their ill-gotten wealth. Galba, or rather his confidants who governed him, then proceeded against the purchasers of their property, and confiscations became again the order of the day. At the same time Galba exercised great parsimony in the administration, and endeavoured to enforce a strict discipline among the soldiers, who had been used to the prodigality and licence of the previous reign. The emperor, who was past seventy years of age, soon became the object of popular dislike and ridicule, his favourites were hated, and revolts against him broke out in various quarters, several of which were put down and punished severely. Galba thought of strengthening himself by adopting Piso Licinianus, a young patrician of considerable personal merit, as Cæsar and his successor; upon which Otho, who had expected to be the object of his choice, formed a conspiracy among the guards, who proclaimed him emperor. Galba, unable to walk, caused himself to be carried in a litter, hoping to suppress the mutiny; but at the appearance of Otho's armed partisans his followers left him, and even the litter-bearers threw the old man down, and ran away. Some of the legionaries came up and put Galba to death, after a reign of only seven months, counting from the time of Nero's death, A.D. 68. Galba was seventy-two years of age at the time of his death. He was succeeded by Otho, but only for a short time, as Vitellius superseded him, and Vespasianus soon after superseded Vitellius. (Tacitus, *Histor.* i.—iv.)

Coin of Galba.
British Museum. Actual size. Brass. Weight, 395 grains.

Reverses of coins of Galba.

GA'LBANUM. Though this drug is one of those which have been the longest known, the plant which yields it still remains undetermined, though it is stated by old writers to be a native of Syria. The Greek name *chálbane* (χαλβάνη) is evidently the same as the Hebrew *chelbenah*, by which the same substance is supposed to be alluded to in the Book of Exodus. Arabian authors describe it under the name *barzud*. The Persians call it *birzud*, and give *birreja* as its Hindú synonyme. That the same substance is intended, is evident from *khulyan* and *metonyon*, as stated by Dr. Royle (*Illustr. Himal. Bot.* p. 23), being given as its Greek synonymes, which are evident corruptions of *chalbane* and *metopion*, the names of this substance in Dioscorides. The plant yielding this substance is called *kinneh* and *nafeel* by Arabian and Persian authors, by whom it is described as being jointed, thorny, and fragrant. Under the first name it is noticed in the original of Avicenna, but omitted in the Latin translation. D'Herbelot (*Bibl. Orient.*) however states, that the plant yielding galbanum is called *ghiarkust* in Persia. These names are interesting only as showing that both the plant and gum-resin appear to have been familiarly known to both Arabians and Persians, and that therefore the former is probably a native of these countries, though usually stated to be only a native of Syria. But if so, it could hardly have escaped the notice of the numerous travellers who have visited that country.

The plant usually described as yielding this long-known gum-resin is Bubon Galbanum, a native of the Cape of Good Hope, which Hermann described as yielding spontaneously, by incision, a gummy, resinous juice, similar to Galbanum; but Mr. Don has observed that this plant possesses neither the smell nor the taste of Galbanum, but in these particulars agrees better with fennel; and its fruit has no resemblance whatever to that found in the gum. The fruit, commonly called seed, was early ascertained by Lobel to be that of an umbelliferous plant, broad and foliaceous, which he picked out of Galbanum, and, having sowed, obtained a plant, which he has figured under the name of *Ferula galbanifera*. This has been lost or become confounded with other species; but it is probable that it was the plant yielding Galbanum, as Mr. Don has recently obtained fruit in like manner, and something similar, which he has determined to be allied to the genus Siler; but differing in the absence of dorsal resiniferous canals, and the commissure being furnished with only two. The carpels are about nine lines in length and four broad, flat internally and somewhat converse externally. As the plant is still unknown, it is well worthy the investigation of travellers in the East, who might otherwise suppose, from the name, assigned from the seed, having been adopted in the 'London Pharmacopœia,' that the plant was as well known as its product.

Three sorts of GALBANUM are distinguished: 1, galbanum in grains or tears; 2, galbanum in masses; and 3, Persian galbanum. The two former come from Africa, especially from Æthiopia; the third sort from Persia. Galbanum in tears is most likely the spontaneous exudation from the plant; and that in masses, obtained by incisions. The first sort occurs in irregular, generally oblong grains, mostly distinct, but sometimes agglutinated together, about the size of a lentil or small pea, of a colour verging from whitish into yellowish brown, more or less diaphanous, opake, or shining with a resinous lustre. The odour is strongly balsamic, and disagreeable. The taste is resinous, sharp, bitter, and disagreeable. Specific gravity 1·212.

It is partially soluble in alcohol, and the solution, as well as the strong white smoke which is evolved when galbanum is melted in a platinum spoon, reddens litmus paper. It consists chiefly of resin, gum, volatile oil, and a trace of malic acid.

Galbanum in masses consists of irregular pieces of a yellowish or dark brown colour; the odour is stronger than that of the preceding kind, which, in its general characters, it much resembles, except that it can be powdered only during the low temperature of winter. Geiger says that when this variety is pure, it is not to be reckoned inferior to the former. Persian galbanum, being very soft and tenacious, is sent in skins or chests. It often contains many fragments of plants.

Galbanum, like other umbelliferous gum-resins, is antispasmodic, expectorant, and externally rubefacient. It is inferior in power to assafœtida, but usually associated with it in pills and plasters.

GA'LBULA (Zoology). [HALCYONIDÆ; JACAMAR.]

GA'LEA (Zoology). [ECHINIDÆ, vol. ix., p. 259.]

GALENA. [LEAD.]

GALE'NA. [ILLINOIS.]

GALE'NUS, CLAU'DIUS, one of the most celebrated and valuable of the antient medical writers, was born at Pergamum, A.D. 131. The exact time of his death is not known, but as he speaks of Pertinax and Severus as emperors, we may conclude that Suidas (v. Γαληνός) is not far from the truth in stating that he lived to the age of seventy. He was early instructed in the doctrines of the Aristotelian and Platonic philosophy, and appears also to have devoted some time to the study of the peculiar tenets of the other sects; for while yet very young, he wrote commentaries on the Dialectics of the Stoic Chrysippus.

His anatomical and medical studies were commenced under Satyrus, a celebrated anatomist; Stratonicus, a disciple of the Hippocratic school; and Æschrion, a follower of the Empirics. After the death of his father, he travelled to Alexandria, at that time the most famous school of medicine in the world. His studies were so zealously and successfully pursued, that he was publicly invited to return to his native country. At the age of 34, he settled himself in Rome, when his celebrity became so great from the success of his practice, and more especially from his great

knowledge of anatomy, that he quickly drew upon himself the jealousy of all the Roman physicians. At the solicitation of many philosophers and men of rank, he commenced a course of lectures on anatomy; but by the jealousy of his rivals he was quickly compelled to discontinue them, and eventually to leave Rome entirely.

The instruction which Galen had received in the principles of the various sects of medical philosophy, had given him an acquaintance with the peculiar errors of each, and he speaks of them all at times in the language of no measured contempt. The school which was founded by himself may justly merit the title of Eclectic, for its doctrines were a mixture of the philosophy of Plato, of the physics and logic of Aristotle, and of the practical knowledge of Hippocrates. On many occasions he expresses himself strongly on the superiority of theory to mere empiricism; but upon those matters which do not admit of being objects of experience, such as the nature of the soul, he confesses his ignorance and inability to give any plausible explanation.

But in order to form a correct estimate of the merits of this physician, it is necessary for us to mention particularly some of his contributions to medical science. Anatomy was at all times the favourite pursuit of Galen, but it does not appear that he had many opportunities of dissecting the human subject. This we may infer with certainty from the gratification he expresses at having discovered a human skeleton at Alexandria, and having been enabled to make observations on the body of a criminal which had remained without burial. His dissections were principally confined to the apes and lower animals; and it is to this circumstance that many of the errors in his description are referrible: for from the examination of these animals he attempted to infer analogically the structure of the human body. He describes the sternum as consisting of seven pieces instead of eight. He supposes the sacrum to consist of three pieces instead of five, and looks upon the coccyx as a fourth, whereas it is a distinct bone in men till twenty or twenty-five, and in women as late as forty-five.

His descriptions of the muscles appear to be more generally correct. He described for the first time two of the muscles of the jaws, and two which move the shoulder. In addition to these he discovered the popliteal muscles and the platysma myoides. He denied the muscular texture of the heart on account of the complicated nature of its functions, but he gave a good description of its transverse fibres and its general structure. The knowledge of the vascular system which Galen possessed does not appear to have been greater or more accurate than that of his predecessors. He supposed the veins to originate in the liver, and the arteries to take their rise from the heart. He likewise showed by experiment, in opposition to Erasistratus, that the arteries contained blood, and not merely the animal spirits, as that physician maintained. He had observed the structure and use of the valves of the heart, and, arguing from their evident intention, concluded that a portion of the blood passed with the animal spirits from the pulmonary artery into the pulmonary vein, and so to the left side of the heart. He was also aware of the connection between the veins and arteries by means of the capillary vessels. The existence of the ductus arteriosus and foramen ovale during the stage of fœtal life was not unknown to him, and he had also noticed the changes which they undergo after birth.

Galen understood generally the distinction between nerves of sensation and nerves of motion, but his knowledge upon this point does not appear to have been great; for he supposed that the former proceeded only from the brain, and that the latter had their origin exclusively in the spinal marrow. This opinion is the more remarkable, as he himself describes the third pair of cerebral nerves, or principal motor nerve of the eye. In his description of the cerebral nerves, he notices the olfactory, though somewhat indistinctly, the optic, the third pair, two branches of the fifth, the two divisions of the seventh pair, and some branches of the par vagum and hypoglossal nerves, but he appears to have confounded these together very much in his description. He detected the mistake of those anatomists who thought there was an entire crossing of the optic nerves, but fell himself into the error of supposing that no decussation at all takes place.

In order to form correct physiological views, it is necessary to employ many and varied experiments, and to modify them in different ways, that we may be able to satisfy the numerous conditions which every problem in physiology presents. To this mode of inquiry Galen sometimes had recourse, and it were to be wished that he had more frequently made use of it. To prove the dependence of muscular motion upon nervous influence, he divided the nerves which supply the muscles of the shoulder, and found that after the division all power of motion ceased. But he does not seem to have noticed that the nervous influence is only one of the many stimuli which call the muscles into action. As he considered the heart to be devoid of nerves, he might have avoided this error, had he not fortified himself against the truth, by assuming that its structure is not muscular. He also deprived animals of their voice by dividing the intercostal muscles, by tying the recurrent nerve, or by injuring the spinal cord. In theoretical physiology his arrangement of the vital phenomena deserves to be particularly recorded, as it forms the groundwork of all the classifications which have since been proposed. It is founded upon the essential differences observed in the functions themselves. Observing that some of them cannot be interrupted without the destruction of life, and for the most part are unconsciously performed, whilst another class may be suspended without injury, are accompanied by sensation, and subject to the power of the will, he divided the functions into three great classes. The vital functions are those whose continuance is essential to life; the animal are those which are perceived, and for the most part are subject to the will; whilst the natural are performed without consciousness or control. He then assumed certain abstract principles upon which these functions were supposed to depend. He conceived the first to have their seat in the heart, the second in the brain, and the third in the liver. Thus the pulsations of the heart are produced by the vital forces, and these are communicated to the arteries by the intervention of the *pneuma*—this is the more subtle part of the air, which is taken in by respiration, and conveyed from the lungs to the left side of the heart, and from thence to the different parts of the body. In the brain the pneuma forms the medium by which impressions from external objects are conveyed to the common sensorium. The same principle is applied to the explanation of the natural functions also. Observing that these forces are not sufficient for the explanation of the different vital phenomena, Galen had recourse to the doctrine of elements, of which, after the example of Aristotle, and before him Plato in the 'Timæus,' he admits four, and from the mixture of these deduces the secondary qualities. It may be worth while to observe how he employs this hypothesis in his treatise 'De tuendâ Valetudine' (Ed. Johan. Caii. Basil, ap. Froben. 1549), in the explanation of the phenomena of health and disease. The injurious influences to which animal bodies are liable are of two kinds: innate or necessary, and acquired. The former depend upon their original constitution. They are formed of two substances: the blood, which is the material (ὕλη); and the semen, the formative principle. These are composed of the same general elements, 'hot, cold, moist, and dry, four champions fierce,' or, to express them in their essences instead of their qualities, fire, air, water, and earth. Their differences depend upon the proportions in which these elements enter into their composition. Thus in the semen the fiery and aeriform essences predominate; in the blood, the watery and earthy; and in the blood the hot is superior to the cold, and the moist to dry. The semen again is drier than the blood, but yet upon the whole is of a moist nature: so that in the original formation of the body there is a predominance of the moist principle. After birth therefore there is a necessity for an increase of the dry principle. This is obtained not from the earth itself, but through the medium of fire. From the increasing influence of this principle, the changes which take place in the body during life are to be explained: as for instance, the softness and flexibility of the limbs in childhood compared with their rigidity in old-age. By eating and drinking we obtain a fresh supply of the dry and moist principles. By respiration and the pulsations of the heart, a due supply of the cold and hot principles is kept up. But as they cannot be obtained in a fit state for the different uses of the animal economy, organs are necessary to digest, separate, and remove the unsuitable portions.

Health consists in the perfect and harmonious admixture of these various elements. But we must assume, in addition, that the body is free from pain, and that there is no obstacle to the due performance of the functions. From this idea of health we may easily form the conception of

disease. It is that state of body in which the functions are in any way interrupted. It depends upon some disproportion in the constituent elements, or some unnatural condition of the organs. The causes of disease are divided by Galen into occasional and predisposing. The latter are supposed to depend upon some degeneration of the humours. This degeneration was called by him a putrefaction. Thus the quotidian fever is referred to putrefaction of the mucus; tertian, to that of the yellow bile; and quartan, to that of the black bile—this last humour being slow of motion, and requiring a greater time for the completion of the paroxysm. It was upon this theory of the putrefaction of the humours that the practice of physicians was founded for centuries after the death of Galen, and their remedies were directed to the expulsion of the supposed offending matter. Inflammation depends, according to Galen, upon the passage of the blood into those parts which, in their normal condition, do not contain it. If the blood be accompanied by the spirits, the inflammation is spirituous: if the blood penetrates alone, it is phlegmonous. Erysipelatous inflammation is caused by the admixture of bile; œdematous, by that of mucus; and schirrous, by the addition of black bile. The same divisions of inflammation are still retained by systematic writers, but we are content to abstain from referring them to these assumed causes.

The reputation of Galen was established upon the general reception which his theories met with; and his passion for theorizing was so great that he has left us but few good descriptions of disease. In these his principal object seems to have been to display his own talent for prognosis. From a character like this we are not to expect much information in the application of particular remedies, but the general principles which he lays down in respect to indications of treatment are worthy of notice. He directs us to draw our indications especially from the nature of the disease; but if this be undiscovered, from the influence of the seasons and the state of the atmosphere, from the constitution of the patient, his manner of living, or his strength, and in some few instances, from the accession of the disease. He is said to have occasionally performed surgical operations, but during his stay in Rome he commonly refused to do so, in compliance with the custom of the Roman physicians.

The unbounded influence which the authority of this great and learned physician exercised over the minds of his successors, unquestionably contributed to retard the progress of medicine. For while physicians were occupied in the study of his works, and in vain attempts to reconcile the phenomena of nature with the dicta of their master, they had little time and less inclination to interrogate Nature herself, and pursue the study of medicine in those fields in which alone it can be followed with success.

Galen was a most voluminous writer. Though many of his works are said to have been burnt in his house at Rome, and others in the course of time have been lost, there are still extant one hundred and thirty-seven treatises and fragments of treatises, of which eighty-two are considered undoubtedly genuine. From thirty to fifty treatises are still in MS.; and one hundred and sixty-eight are mentioned as the ascertained number of those that are lost. The writings of Galen are valuable, not only for the history of medicine, but the great variety of miscellaneous matter which they contain.

Numerous editions of his works have been published, and several Latin translations since the discovery of printing. Five Latin editions of the collected works of Galen were published before the Greek text: the first Latin edition is that by Bonardus, Venice, 1490, 2 vols., fol. His 'Historia Philosophica' was printed by Aldus in 1497, together some treatises of Aristotle and Theophrastus; and in 1525 the same printer published the first complete edition of the Greek text at Venice, in 5 vols. fol., which was edited by And. and Fr. Asulanus, and was dedicated to Clement the Seventh. The text of this edition was by no means correct; but the impressions on large paper are scarce and valuable. An edition was published at Basle, 1562, in 4 vols. folio, with prolegomena, by the naturalist Gesner. His treatises, 'De Methodo Medendi,' 'De Naturali Facultate,' 'De Sanitate Tuendâ,' were translated by our countryman Linacre, and an edition of his treatise, 'De Sanitate Tuendâ,' and of some other works, was published by Caius. More recently an edition in Greek and Latin has been published by C. G. Kühn (19 vols. 8vo., Lipsiæ, 1821-1830). Most of the writings of Galen exist also in Arabic, and some in Hebrew translations. The reputation of this great writer was for a long time as unbounded and his authority as absolute among the Arabs as among the physicians of Europe.

(Harvey, *Exercit. Anatom.*; Sprengel's *Hist. of Medicine*; Clark's *Report on Animal Physiology, from the Trans. of Brit. Assoc.*, 1834.)

GALE'OLA. [ECHINIDÆ, vol. ix., p. 259.]

GALEOLA'RIA. [DIPHYDES, vol. ix., p. 10; SERPULIDÆ.]

• GALEOPITHE'CUS (Zoology). [PLEUROPTERA.]

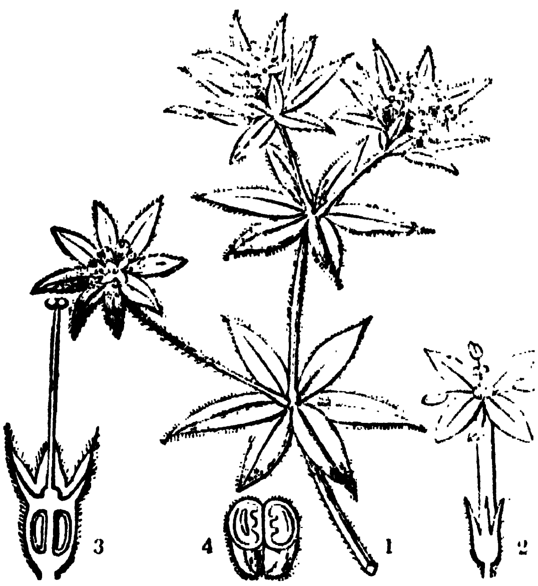
GALEO'TES. [IGUANIDÆ.]

GALERI'TES. [ECHINIDÆ, vol. ix., pp. 259, 261.]

GALERIUS. [MAXIMIANUS.]

GA'LGULUS (Zoology). [ROLLERS.]

GALIA'CEÆ, a natural order of Exogenous plants called Stellatæ by Linnæus, and merged in Cinchonaceæ by the school of Jussieu. It consists of herbaceous, usually square-stemmed plants, with a scabrous surface, verticillate leaves, and monopetalous flowers with an inferior didymous fruit enclosing a couple of seeds containing an embryo lying in a great quantity of horny albumen. Some yield a dyeing substance in their roots, as the various species of Madder, but the greater part are useless weeds. One of our common British species of Galium, viz., G. verum, is astringent, and was formerly used by farmers to curdle milk.



1, Sherardia arvensis; 2, a perfect flower, magnified; 3, a vertical section of the same, without the corolla; 4, a transverse section of a ripe fruit.

GALIA'NI, FERDINANDO, was born at Chieti, in the Abruzzo, in 1728, and studied at Naples, where he first attracted attention by some humorous compositions which he published under an assumed name, to ridicule certain pedantic academicians ('Componimenti varii per la morte di Domenico Jannaccone carnefice della Gran Corte della Vicaria,' 1749). In the following year his important work, 'Della Moneta,' on the 'coin,' or 'currency,' was also published under an assumed name. In this work he established the principle, which was then far from being acknowledged, that money is a merchandize, and that its value and interest ought to be left free like other goods. He contended also that abundance of money and consequent high prices are not an evil, as was supposed by many, and that in countries where low prices prevail the people are generally most miserable. This work produced a great sensation on the Continent, and especially at Naples, where the government adopted its principles, and left the trade in bullion free. It is generally believed that Bartolommeo Intieri and the Marquis Rinuccini, two Tuscan economists of that time, furnished Galiani, who was then a young man scarcely twenty-one years of age, with their ideas on the subject, which Galiani extended and produced in a readable shape. He published a second edition of this work, 30 years after, in 1780, with additions. In the 1st book he examines the intrinsic value of the precious metals, independent of their use as currency; in the second he treats of the use of a metallic currency as a

medium of exchange; and in the third he discusses the relative value of the three metals used for coin, the conventional value of the coined currency of a country in relation to the prices of goods, and the occasional expedient adopted by some governments to raise the value of the currency, as the Romans did after the first Punic war, and as Louis XIV. did in France.

In 1759 Galiani was sent to Paris as secretary of legation, and his vivacity, wit and repartee rendered him a favourite among the fashionable and literary coteries of that capital. He remained in Paris several years, visited England and Holland, and on his return to France wrote his 'Dialogues sur le Commerce des Blés,' which was his second work on political economy. He did not publish this essay himself, but left the MS. in the hands of Diderot, who had it printed in 1670. The French economists were then divided into two parties, one of which advocated a free trade in corn, and the other was opposed to it. An edict, published in 1764, permitting the free exportation of corn, was followed by a rise of prices and a scarcity, which by some were considered as the effects of that measure, whilst others denied the inference. Galiani supported neither of the two systems absolutely: he contended that the laws concerning the corn-trade must vary according to the situation of various states, the nature and cultivation of the respective soils, the relative position of their corn districts or provinces, and also the form of their governments. In a letter to Suard, dated 1770, he explains himself more clearly on this last topic, saying, 'that under a despotic government a free exportation of corn might prove dangerous, as it might be followed by a famine, which would rouse the people against its rulers; that in a democracy the same freedom is a natural result of the political institutions; whilst in mixed and temperate governments the freedom of the corn-trade must be modified by circumstances.' Galiani censured the free-exportation edict of 1764, and he proposed instead of it certain duties on the exportation of corn, and a lesser duty on the exportation of flour, and a duty likewise on the importation of foreign corn. He notices in his work the small manufacturing states with little territory, like Geneva, and surrounded by powerful and occasionally hostile neighbours, in which he thinks well-stored granaries are as necessary as in a garrison-town; and the states with a territory unproductive in corn, such as Genoa, in which he contends that the corn-trade ought to be perfectly free.

On his return to Naples, Galiani was appointed by the king to the Board of Trade, and afterwards to the Board of Finances, and to the superintendence of the crown domains. His health, naturally weak, suffered from constant application, and he died in October, 1787, at the age of 59 years. He left in MS. a commentary or series of disquisitions on the life and character of Horace and the spirit of his poems, parts of which he showed to several of his friends, who spoke highly of the work, extracts of which are found in the *Correspondence de Galiani avec Madame d'Epinay*, Paris, 1818; in the notes to the *Traduzione d'Orazio di T. Gargallo*, Naples, 1820; in the *Vita dell' abate Ferdinando Galiani, scritta da Luigi Diodati*, Naples, 1788; and in the *Mélanges de l'abbé Suard, tirés de la Gazette littéraire d'Europe*: see also Ugoni, *della Letteratura Italiana*, vol. ii., art. 'Galiani.'

GALICIA, the Kingdom of, is the north-eastern province of the Austrian dominions, and lies between 47° 10′ and 50° 50′ N. lat., and 18° 54′ and 26° 37′ E. long. It includes the country formerly called the Buckowine, and is bounded on the north by the republic of Cracow, Poland, and Russia; on the east by Russia; on the south-east by Moldavia; on the south and south-west by Transylvania and Hungary; and on the west by Hungary, Austrian Silesia, and Prussian Silesia. Galicia derives its name from the former principality of Haliczia or Galiczia, which, together with a considerable portion of Red Russia, once formed part of Hungary, but was incorporated with Poland in the year 1374. Its antient connexion with Hungary served as a pretext to the Empress Maria Theresa, in 1772, when Poland was enfeebled by intestine divisions, to claim its restoration; a claim which the Poles were forced to concede by the treaty of the 18th September, 1773, in consequence of which that part of the republic, now termed Galicia, was surrendered to Austria, and annexed to its dominions under the name of the kingdom of Galicia and Lodomeria. Its area is variously computed; but that of the Austrian quarter-master-general's department, which states it to be 32,508 square miles, is considered the most accurate. Liesganig however, who completed his triangular survey in 1821, estimates it at 32,949 square miles. The population rose from 3,695,285 in 1816 to 4,293,488 in 1825; and from the last numbers to 4,548,334 in 1834. The present population is estimated at nearly 4,600,000.

Galicia spreads out, in its whole length on the northern side of the Carpathian mountains, into extensive plains: those mountains extend their arms deep into the kingdom, and on the west, the Beskide branch of them stretches as far as the banks of the Vistula, rising almost abruptly out of the lowlands into heights of 2000, and sometimes of 4600 feet. The most elevated summit in this quarter is the "Babia Gora," (Women's Mount), which Staszic estimates at 5410, and Hacquet at 5850 feet above the level of the sea. In the south-west, the Patra or central range of the Carpathians, with their peaked summits and desolate naked aspect, rise to still greater elevations; the great Kryvan to about 8300, and the Rohicz to 7230 feet. The branches of this range penetrate much deeper into the country than those of the Beskides. The Buckowine, now the circle o Czernovitz, is covered with offsets of the Carpathians, and is altogether a mountain region. The mountains are ful. of small lakes, which are here called Sav, Plesse, or "Eyes of the Sea;" the largest of them, which lies to the north of the Great Kryvan, is called the Fish Lake; it is at an elevation of about 4550 feet above the level of the sea, but does not exceed 1600 paces in length, or 500 feet in breadth; it has a depth of 192 feet, and forms an almost perfect oval.

The northern part of Galicia is an extensive plain, in some parts intersected by low ranges of hills; and in the western part also a dead level begins at Skavina on the right bank of the Vistula, and varying in width, extends to the banks of the San. The soil of the plains consists almost universally of loam and sand; the most remarkable accumulation of the latter is in what is called the Sand Mountain (Sandberg) near Lemberg.

The rivers of the western part of the kingdom of Galicia belong to the basin of the Vistula; and those of the eastern, to the basins of the Danube and the Dniester. The Vistula forms the western boundary next to Poland for about 180 miles, flowing north-eastwards from the spot where Austrian and Prussian Silesia and Galicia converge to a point, and quitting the kingdom at Popowiecze, a village opposite Zavichost at its northern extremity; this river increases in breadth along this frontier-line from about 120 to nearly 200 paces, and has a rapid current until below Cracow, the difference in the elevation of its bed from the point just mentioned and that city being about 200 feet. The tributaries of the Vistula, on the side of Galicia, are the Dunayec or Danayez, which flows down from the Carpathians, is navigable in the low country, receives the Poprad, also a navigable stream, and other rivers in its course, chiefly northwards, through the circles of Sandecz, Bochnia, and Tarnof, and falls into the Vistula near Novopole, opposite Opatoviec, after a course of about 105 miles. This river, like all those which flow from the Carpathians, overflows its banks in rainy seasons, does much damage and is dangerous to navigate. The Wysloka is formed at Yaslo out of the junction of the Dembowka, Ropa, and Yasielka, flows through the circles of Yaslo and Tarnof, and after a northern course of about 70 miles, joins the Vistula near the village of Ostróf, in the north of Galicia. The San or Saan, the most important tributary of the Vistula in this quarter, rises in the south-western extremity of the circle of Sambor near Sianki, a village on one of the most northerly declivities of the Carpathians, takes a north-westerly direction to Sanok and Bynof, whence it runs eastwards to the town of Przemysl, and thence flows north-westwards through a low country past Yaroslaf until it falls into the Vistula near Lapiszof. Its whole length is about 180 miles, and its chief tributaries are the Wyslek and Tanef. The Bug, which has its efflux in the Vistula also, does not become a considerable stream until it has quitted Galicia; it rises near Galigory to the east of Lemberg, flows westwards when above the latitude of that town, and before it reaches Busk turns northwards and afterwards north-westwards, and leaving Galicia below Sokal, enters Poland. The Dniester, another of the considerable rivers in this kingdom, through which it flows for a distance of about 310 miles, has its source in the Carpathians in the western part of the circle of Sambor, winds through

that circle, Brzezany, Stry, Stanislavof, and Kolomea, and having formed the boundary-line between Galicia and Russia from Czortkof to Orkop beyond Czernovitz, enters the Russian territory. Eastern Galicia has three other large rivers: the Pruth, which rises in the Carpathians within the circle of Stanislavof, flows through that circle as well as Kolomea and Czernovitz in the Buckowine, and passes over into Moldavia below Pentuluy; the Sered, which has its source near Pursuka and leaves the Buckowine below Sereth; and the Moldava, which rises in the circle of Czernovitz and soon afterwards quits the Buckowine, whence it enters Moldavia. The south-eastern districts of Galicia are also watered by the Golden Bistriza, a tributary of the Sereth. There are no canals. According to an enumeration made some years ago, the mineral springs consisted of 11 sulphuretted springs, 12 chalybeate, and 6 acidulous. The most frequented are the chalybeate waters of Krynieza, and the sulphuretted springs of Sklo, Lubien, and Konopkofski.

The climate of Galicia is colder than that of any other possession of Austria, in consequence of the proximity of the Carpathians. The summer is generally short, and the grape never ripens: the winter is very severe for six months at least, and it is not uncommon to see deep snow lying in the middle of April, or an oat-crop buried by the snow, in the vicinity of the Beskide and other Carpathian mountains. The moist and swampy plains in the northern part of the kingdom render that quarter also very chilly and raw.

The soil is of a very varied character. In the neighbourhood of the Carpathians, where sterile rocks or cold clay abound, the husbandman has difficulty in raising even sufficient barley, oats, and potatoes, for his own consumption. But towards the plains, the soil becomes richer and more productive: the most fertile parts are those perhaps about Yaroslaf, such districts in the circle of Zloczof where limestone forms the substratum, the greater portion of the circles of Stanislavof and Kolomea, and the newly cleared lands in the Buckowine. In many parts the soil is so light, that the grass, underwood, and even trees, quickly wither under the heat of the sun.

Galicia abounds in sandstone, granite, sand of a very superior grain, quartz, slate, yellow and common clay, potter's earth, yellow ochre, marble, gypsum, &c. Mountain crystals, agates, jaspers, ordinary opal, alabaster, &c., are found in several spots. The Carpathians are rich in metals, particularly iron, which is found along the whole line of the Carpathians, from the circle of Sandecz to the frontiers of the Buckowine; but the produce does not exceed more than fifteen or, at the utmost, eighteen pounds of metal in every hundred-weight of ore. Bog-iron likewise is met with in the circles of Stry and Zolkief. Gold obtained in small quantities in the circle of Sandec, and gold-dust in the vicinity of Kirlibaba. Veins of silver are found in the lead of Mount Dudul, near that place, and it is also extracted from the calamine obtained near Truska wicze. Poszorita, in the Buckowine, produces good copper ores in the proportion of three, and sometimes five pounds per hundred-weight of mica slate. Native sulphur occurs at Svoszovice, in the circle of Bochnia, and Sklo, in that of Przemysl. Coal is found near Moszyn, Kuty, and Skwarczva. The northern side of the Carpathians contains enormous masses of rock-salt, and the country is full of salt-springs, especially the Buckowine.

The population of Galicia are indolent and ignorant, oppressed by the Fröhndienste (services), which for Galicia alone amount to 31,246,464 days in the year, and the system of husbandry is lamentably defective and imperfect. Independently of the Buckowine, the land available for useful purposes is about 16,394,900 acres; but including that province the quantity converted to use is not more than about 6,211,900 acres in arable land; garden ground, 395,780; fallows, 97,970; converted into ponds, &c., 131,650; meadow-land, 1,876,940; and employed for feeding sheep, cattle, &c., 1,682,360; amounting altogether to 10,396,600 acres, to which must be added 4,998,870 of forest and woodland. The husbandry of Galicia is in a low state; the farmer's waggons are made without iron, his horses are never or seldom used at the plough, and he can scarcely afford to lay manure on his ground. The principal grain produced is wheat, rye, oats, and barley, and the yearly growth is estimated at about 7,200,000 quarters of corn, of which about 1,560,000 quarters are of rye; 2,071,000 of barley; 2,900,000 of oats; 670,000 of wheat, and 22,220 of maize. The crop of hay is said to be about 973,000 tons. Rye, buckwheat, pease and beans, potatoes and other common vegetables, succory, clover, flax and hemp, tobacco, aniseed, rape and other seed for making oil, a few hops, &c. are also grown. The supply of fruit is very scanty. The forests consist principally of pine-wood, and there are large tracts of underwood. The beech was formerly much more abundant on the Carpathians than at the present day, otherwise the Buckowine. from 'buk,' which signifies the red beech, would scarcely have been the patronymic of that province. In some parts the oak attains to a majestic growth. Tar and potashes are made in considerable quantities.

The population has increased since the year 1776, when it amounted to 2,480,885, to its present amount of nearly 4,600,000. The cholera alone in 1831 carried off 96,081 individuals, which is upwards of 2 in every 100 souls. In 1823 the number of deaths was 106,929; in 1829, 148,240; and in 1830, 155,155. Among the latter were those of 3758 persons between the ages of 80 and 100, and 220 above the age of 100. Of the inhabitants about 2,900,000 are of Polish descent, chiefly located in the Western provinces, and 1,900,000 are Ruthenes or Russniaks, a rude, uncivilized race of men, who have spread into the centre of Russia, and are also numerous on the Hungarian side of the Carpathians: they inhabit the circles of Galicia east of the San. The remaining part of the population consists of about 270,000 Moldavians in the Buckowine, 250,000 Jews, who are scattered throughout the kingdom, and a mixed race of Germans, Hungarians, &c.

The majority of the inhabitants are Roman Catholics: there are besides about 1,800,000 who conform partially to the rites of the Roman Catholic church, 270,000 Greek non-conformists, 4000 Armenians, and 5000 Protestants. The Roman Catholics are in ecclesiastical matters in charge of the Archbishop of Lemberg and the bishops of Przemysl and Tarnof. Their dioceses contain 734 benefices, 38 monasteries, 13 nunneries, and a college of Jesuits. The Armenians, though so few in number, have an archbishop at Lemberg, and compose 8 cures of souls. The Græco-Catholics, mostly Russniaks, have also their own archbishop at Lemberg, and a bishop at Przemysl, and their establishment consists of 1488 benefices, 14 monasteries, and 3 nunneries. The Greeks, wholly Moldavians, are under a Greek bishop at Czernovitz in the Buckowine, and compose 274 cures of souls: they have 3 monasteries. The Protestants are under a superintendent at Lemberg.

The number of benevolent institutions is considerable, and comprises eighteen Christian and three Jewish hospitals or asylums for the sick or diseased, a hospital of the Benevolent Brothers, six hospitals conducted by the Benevolent Sisterhood, 312 infirmaries and refuges for the indigent, and twenty-seven poorhous

The government of Galicia is on the same footing as that of the other hereditary possessions of Austria. The highe authority in civil affairs is the Board of Provincial Administration at Lemberg (*das Landes Gubernium*), to which the whole nineteen circles of the kingdom are subordinate. The court of appeal and chief criminal court are in the same town, where also are the head-quarters of the commander-in-chief for Galicia.

The scholastic establishments are very inadequate to provide for the general education of the people. The whole number scarcely amounts to 1400, among which are a university and an academy at Lemberg, three philosophical seminaries at Przemysl, Czernovitz, and Tarnopol, thirteen gymnasia, attended by about 1400 pupils, two schools for merchants' sons, mechanics, &c., at Lemberg and Brody, a normal school at Lemberg, thirty-one head national schools, 1303 parochial and twenty-two girls' schools. It has been calculated that not more than one in every eight children capable of receiving instruction attends any school.

There are seventy-two public establishments for the propagation of improved races of horses and military haras at Radantz in the Buckowine, and Olchowek in the circle of Sanok. The best native horses of the Polish breed are bred in the western circles. The increase has been considerable throughout Galicia, for in 1810, the stock was 214,962; in 1823, 407,662; and in 1830, 497,808. Large droves of horned cattle are fed, the finest being brought from Moldavia: in 1823, the stock was 499,226 oxen and bullocks, and 926,569 cows; and in 1830, 562,865 and 988,332.

Much has been done towards improving the race of sheep, and Galicia now produces some fine wools; the stock was 381,101 in 1810; 653,429 in 1823; and 812,412 in 1830. In the eastern districts especially much honey and wax are made; the red wax of the Buckowine is in great repute. The rivers and small lakes, and ponds, the last of which occupy an area of nearly 206 square miles, are well supplied with fish. The bear, wolf, fox, beaver, roebuck, stag, lynx, marmot, eagle, vulture, swan, heron, wild goose, squirrel and hare are the principal wild animals.

The mining industry of Galicia is chiefly confined to iron and salt. Silver, copper, and lead are the product of the Buckowine: of silver, the produce of Kirlibaba is about 500 marks annually, and of lead in combination with a small portion of silver, about thirty-three tons. The copper-mines of Poszorita yield about fifty tons of metal per annum. The iron-mines in the Carpathians, which comprise 271 shafts, do not yield more than about 2700 tons of metal. The mountains of Galicia abound in rock-salt. The mines of Wieliczka are of great magnitude and well known, and produce four-fifths of the whole quantity raised; the remainder is obtained chiefly from the mines of Bochnia. There has been a great decrease in the annual produce of late years; it was 53,300 tons twenty years ago, and at present it is not more than 42,500. A fine kitchen-salt is made from the saline springs in the eastern parts of the kingdom: there are twenty-two works, producing about 15,200 tons. The quantity exported is about 32,000 tons. A very small quantity of coal is raised at Myszyn, in the circle of Kolomea, and the sulphur-pits at Svoszovice produce about [illegible] tons of pure sulphur yearly. Mineral pitch is distilled into naphtha at the government works in the circles of Sambor, Kolomea, and Stanislavof, to the extent of about 70,000 gallons per annum.

The manufactures of Galicia are gradually extending, though they are still on a confined scale. The country people in general make the materials for their clothing. The spinning and weaving of flax and hemp give employment to thousands. They manufacture very coarse and durable linen, and in some parts a few fine cloths, damask and table linen, &c. The whole number of looms thus employed is about 4600. The cotton manufacture is inconsiderable. Much woollen yarn is spun, both by hand and machinery; and there are small manufactures of coarse woollens in all parts: the finer sorts are made at Biala, Lipnik, Mikulince, Plotycze, and Zalosce. There are 12 paper-mills, but their produce is of inferior quality. Ship-building is carried on principally in the circles of Przemysl and Reszof: the produce of deals, staves, &c. is considerable; and great quantities of utensils, &c. in wood are made. Brandy is manufactured on almost every large estate; the Jews in particular are considerable distillers, and have upwards of 2000 stills at work. Much tobacco and some beet-root sugar are manufactured. Leather employs many hands; but the production of iron, copper, and other metallic articles is limited. Potter's ware, earthenware, and ordinary china, glass, and flints may be added to this enumeration.

The foreign trade of Galicia is very limited, a circumstance owing to the position of the country, the want of enterprise and capital, and the difficulty of navigating the rivers. The lines of communication by land, which are the principal channels of internal intercourse, are in the hands of Jewish carriers. The exports consist of cattle, skins and hides, wool, grain, salt, timber, potashes, aniseed, horses, &c., and the imports of raw materials from Hungary, Poland, Russia, Turkey, &c., and of wines and manufactured goods and colonial produce.

Galicia contains 19 *circles*, 95 *towns*, 194 *market-towns and villages*, 6050 *villages and hamlets, and about* 660,000 *houses.*

Circles.	Area: sq. ml.	Towns.	Market-Towns and Villages.	Villages, &c.	Population. 1830.	Chief Towns.
Wadovice	1372	11	2	349	325,601	Wadovicze, 2400 inhabitants; Biala 4000, Kenty 3750, Myslenice 2140, Auschwitz 2000, Saybusz 3000.
Bochnia	1038	5	9	377	213,391	Bochnia 4890, Wieliezka 4550, Podgorze (opposite Cracow) 1670.
Sandecz, or Sandez	1197	8	5	387	227,173	Novy-Sandec, or Sandez 4500, Stari Sandec 3080, Neumark 2830, Piwalezna.
Tarnof	1953	3	11	468	238,453	Tarnóf 2260, Pilezno 1260, Ropezice 1200.
Yaslo	1959	5	12	373	257,573	Yaslo 1770, Biecz 1920, Dukla 2900, Krosno 2200.
Rzeszof	1680	4	13	331	266,604	Rzeszof 4890, Lancut 1880, Przevorsk 2950, Lezaysk 3300.
Lemberg	1025	4	2	173	161,844	Lemberg (capital of Galicia) 56,300, Grodek 3800, Sczerzec 1450.
Przemysl	2058	5	12	372	251,106	Przemysl 7550, Yaroslaf 3400, Yavorof 3500, Sadova wiszaia 2220, Mosciska 2760.
Sanok	2131	10	10	454	256,517	Sanok 1800, Lisko, Dobromyl 1620, Dabiezko, Brzozof 2400.
Sambor	2127	7	3	346	291,851	Sambor 6800, Drohobycz 3150, Komarno 2380, Stari (old) Sambor 2360, Starosól 1100.
Stry	2064	2	10	304	210,680	Stry 5700, Zydaczof 2200.
Stanislavof	1150	5	13	274	226,228	Stanislavof, or Stanislaf 9900, Halicz 1750, Maryampol, Tysmienika 2850.
Kolomea	1183	3	12	204	192,558	Kolomea, or Kolomyya 2290, Suvatyn 6500, Kuty 3600.
Brzezan	2335	3	14	318	299,712	Brzezany 5200, Rohatyn 2770, Bobrka 2600.
Zloczof	1896	6	20	319	239,295	Zloczof 6150, Brody 21,900, Kamienka 1320, Busk 3050, Glynyany 2240, Zalocze.
Zolkief	2041	4	17	267	217,541	Zolkief 4020, Lubiczof 2760, Belz 1640, Sokal 3150.
Tarnopol	1268	4	6	250	210,369	Tarnopol 9500, Mikulince 2050, Trembovla 3050, Zbaracz 5710.
Czortkof	1351	3	19	242	183,800	Zaleszczyki 5560, Czortkof, Husziatyn 1580.
Czernovitz, formerly the Buckowine	3097	3	4	278	282,876	Czernovitz 6600, Sereth 3100, Suczava 4890.
	32508	95	194	6050	4,451,175	

GALICIA, a province of Spain, situated at the north-west extremity of the peninsula, is bounded on the north by the Bay of Biscay, on the west by the Atlantic Ocean, on the south by Portugal, and on the east by the Spanish provinces of Asturias and Leon. Its greatest length from north to south is about 125 miles, and its greatest breadth about 120. Its area may be reckoned at about 15,000 square miles, and its population is vaguely calculated at above one million and a half; but there are no authentic returns, as Miñano himself observes. The country is mountainous, being covered by several offsets of the Asturian chain, one of which runs westward towards Cape Finisterre, and another runs to the south-west along the right bank of the Miño, dividing the waters of that river from those of the Ulla and the Tambro, and reaches the coast of the Atlantic south of Vigo; whilst a third ridge, farther to the east, runs nearly due south, dividing the waters which flow into the Miño from those which run into the Douro, and extends into Portugal. The principal rivers are—1. The Miño, which rises in the mountains of Mondoñedo, in the north-east part of the province, flows southwards by Lugo and Orense, and receives the Sil, which comes from the mountains of Astorga; on touching the frontiers of Portugal it turns westwards, and forms the boundary between Galicia and the Portuguese province of Entre Douro e Minho, after which it passes by Tuy, and enters the Atlantic in 41° 50′ N. lat. 2. The Tambro, which rises in the mountains north of Sant Iago de Compostela, and flows south-west into the Atlantic. 3. The Ulla, which rises in the mountains in the centre of the province: and flowing westwards, enters the Atlantic south of the Tambro. 4. The Lima, which rises in the mountains south-east of Orense, and flowing south-west, enters Portugal near Lindoso. The principal products of Galicia are wine, fruits, flax, wheat, barley, maize: good pastures, which feed a vast quantity of cattle; and abundance of chesnuts, which constitute a common food of the peasantry. The forests supply plenty of wood for fuel and timber for building. The climate is generally chill and moist, but more temperate on the sea coast than in the interior. The Galicians (Gallegos, in Spanish) are a hardy, industrious, and docile people, but not cleanly either in their persons or dwellings.

In their habits they resemble their neighbours the Portuguese, rather than the rest of the Spaniards. They speak a dialect which has considerable resemblance to the Portuguese language. Many of them visit Portugal, and numbers may be seen in the streets of Lisbon and Porto employed as porters and water-carriers; and they have an established reputation for honesty. The principal manufacture of the country is linen, which is made in great quantity and of very good quality, and chiefly in private families; besides supplying their domestic wants, it is exported to other provinces.

The population of Galicia is almost entirely agricultural; landed property is much subdivided, and the great majority of the people do not live in towns and villages, as in most other provinces of Spain, but in detached dwellings on their lands and fields. The parishes contain each a certain number of lugares, and each lugar consists of a certain number of houses, not at a great distance from each other. There are but few towns or large villages: the principal towns, which are at the same time heads of districts, are as follows:—1. La Coruña [CORUNA], which is the residence of the captain-general: 2. St. Iago de Compostela [COMPOSTELA], where is the high court of justice for the whole province; 3. Betanzos, with 5000 inhabitants, on the river of the same name, in a fine country and mild climate, has a few manufactories, and carries on some trade in wine and pickled sardines, which are fished all along this coast; 4. Mondoñedo, with 6000 inhabitants, and a bishop's see, has a royal college, and a seminary for clerical students; 5. Lugo the antient Lucus Augusti, a Roman colony, has now 7200 inhabitants, is a bishop's see, has some fine old buildings, and some remains of Roman walls. It lies on the left bank of the Miño, nearly in the centre of the province, and on the high road from Coruña to Madrid: its climate is among the coldest in Galicia. 6. Orense, with 4000 inhabitants, a bishop's see, a fine bridge on the Miño, and hot mineral waters, is situated in a district abounding with good wine. 7. Tuy, a frontier town on the side of Portugal, situated on the right bank of the Miño, has 6000 inhabitants, is a bishop's see, has a fine cathedral, and is in a fertile district. The other principal towns are: 8. Vigo, on the fine Bay of the same name, forming one of the largest and safest natural harbours in Spain. Vigo carries on a considerable trade with America, exporting wine, sardines, linen cloth and stockings, and other articles of native industry. It has 5700 inhabitants, and is defended by two castles. 9. FERROL.

Upon the whole Galicia is one of the most important provinces of Spain, and not one of the least industrious; its large population, being chiefly of a rural character, is much under the influence of the parochial clergy.

The antient name of the country was Gallæcia: it was partly conquered by Decimus Junius Brutus (Livy's *Epitome*, 56) and afterwards entirely subjugated by Augustus, when it became a part of the Tarraconensis province. It was afterwards conquered by the Visigoths; at a later period the Moors invaded it, but it was soon reconquered by the Christian princes of Asturias, to whose kingdom it was annexed. (Miñano, *Diccionario Geografico de España.*)

GALICTIS. [GRISON.]

GALILEE. [PALESTINE.]

GALILEI, VINCENTIO, a noble Florentine, and father of the illustrious Galileo Galilei, was born in the early half of the sixteenth century, and studied music under Zarlino, though he did not hesitate to attack the opinions of his master, in a *Discorso intorno all' Opere del Zarlino*, and afterwards in his great work, the *Dialogo della Musica antica e moderna*, a folio volume, printed at Florence in 1581. This work, which displays vast erudition and laborious research, has afforded much assistance to the musical historians of later days: but the author occasionally betrays a hardiness in assertion, of which his more philosophic son was never guilty. He was an exquisite performer on the lute, an instrument, he tells us, that was better manufactured in England than in any other part of Europe. He was a rigid Aristoxenian, and his prejudices in favour of the antients were strong; nevertheless his *Dialogo* is well worth the notice of the curious inquirer into musical history.

GALILE'I, GALILE'O, who is most commonly known under the latter, which was his Christian name, was the son of Vincentio Galilei. He was born at Pisa, in Tuscany, on the 15th of February, 1564.

Having acquired, during his boyhood, and under adverse circumstances, the rudiments of classical and polite literature, he was placed by his father at the University of Pisa in his 19th year. Galilei was designed for the medical profession, but that genius for experiment and demonstration, of which he exhibited the symptoms in his earlier youth, having found a more ample scope in the university under the kind auspices of Guido Ubaldi, with whom he had become acquainted through his first essay on the Hydrostatic Balance, he determined to renounce the study of medicine and pursue geometry and experimental philosophy. This resolution, to which his father reluctantly agreed, was highly approved by those who had witnessed his extraordinary talents, and was perseveringly followed up by him through the rest of his life.

His first important discovery was the isochronism of the vibrations of a simple pendulum sustained by a fixed point. This property is not rigorously true where the arcs of oscillation are considerable and unequal, nor does Galilei ever seem to have adopted any contrivance similar to a fly-wheel, by which these arcs may be rendered equal. His knowledge too of the force of gravity, of the decomposition of forces, and of atmospheric resistance, was too imperfect to conduct him to any valuable improvement of the instrument, and hence the fair claims of his successor, Huyghens, so well supported by his treatise 'De Horologio Oscillatorio,' cannot with any justice be transferred to Galilei, whose merits are sufficiently abundant and conspicuous to need no borrowed attributes. This equality or near equality of the time of vibrations Galilei recognised by counting the corresponding number of his own pulsations, and having thus perceived that the pendulum oscillated more slowly or rapidly according to its less or greater length, he immediately applied it to the medical purpose of discovering the state of the pulse; and the practice was adopted by many Italian physicians for a considerable time.

Through the good offices of Ubaldi, who admired his talents and foresaw their future development, Galilei became introduced to the grand-duke Ferdinand I. de' Medici, who appointed him mathematical lecturer at Pisa (1589), though at an inconsiderable salary. Here he commenced a series of experiments on motion, which however were not published until long after, and then only a scanty portion. This circumstance is probably not much to be regretted, since his inferences on the relation of velocity to space were incorrect at first; but he had learned enough from his experimental course to perceive that most of the scholastic assumed laws of motion were untenable.

The mind of Galilei becoming thus unfettered from the chain of authority, he resolved to examine the rival systems of astronomy—the Ptolemaic, with its cumbrous machinery of cycles and epicycles, eccentrics and primum mobile, and the Copernican, which, from its simplicity and gradually-discovered accordance with phænomena, was silently gaining proselytes amongst the ablest observers and mathematicians. He soon discovered and proved the futile nature of the objections then usually made against it, which were founded on a complete ignorance of the laws of mechanics, or on some misapplied quotations from Aristotle, the Bible, and the Fathers: and having also observed, that many who had at first believed the former system, had changed in favour of the latter, while none of those attached to the latter changed to the Ptolemaic hypothesis—that the former required almost daily some new emendation, some additional crystalline sphere, to accommodate itself to the varying aspects of the celestial phænomena—that the appearance and disappearance of new stars contradicted the pretended incorruptibility of the heavenly bodies, together with other reflections which he has collected in his dialogues,—he became a convert to the Copernican system, and, in his old age, its most conspicuous martyr. So strong however were the religious prejudices on the subject of the quiescence of the earth, that Galilei thought it prudent to continue to lecture on the hypothesis of Ptolemy, until time should afford a favourable opportunity to destroy the visionary fabric by incontestable facts.

One of the false doctrines which he first combated was that bodies of unequal weights would fall through the same altitude in unequal times: thus, if one body were ten times as heavy as another, it should fall through 100 yards while the lighter had only fallen through ten. But though the experiment was performed from the leaning tower at Pisa, and both bodies reached the ground at almost the same instant (the small difference, as Galilei rightly observed,

being attributable to the unequal resistances of the air), the witnesses of this experiment were not convinced, so inveterately were they prejudiced in favour of the doctrines in which they had been taught to place implicit belief.

Instead of making converts by his experiments, Galilei discovered that he had made many secret and some open enemies; he therefore left Pisa and removed to the university of Padua (1592), where he was appointed to a professor's chair for the limited period of six years. Here he invented an imperfect species of thermometer, depending on the expansion of the air which remained after a portion was expelled by heat from a narrow glass tube, which was then inverted and immersed in water. His correspondence with Kepler commenced about the same period, and continued with the greatest mutual friendship and regard until his death. A treatise on the Sphere, after the Ptolemaic system, which is attributed to Galilei, appeared about the same time. (Afterwards published at Rome, 1655.)

On his re-appointment to the professorship at Padua his salary was doubled, his fame increased, and his lectures were crowded: but these flattering events were over-balanced by a disagreeable intermittent disease to which he then first became subject, and which pursued him for the remainder of his life. A new star, almost as brilliant as that which directed Tycho Brahe's mind to the study of astronomy, having appeared in 1604, in the constellation of Ophiuchus, he made it the subject of his lectures, which it may be presumed were less explanatory of its cause, than intended as an attack upon the Ptolemaic system. The conjecture now most generally adopted relative to these remarkable phænomena is, that luminosity is not essential to the central body or sun of a planetary system, consequently the star may be quite opaque or partially luminous, and therefore would be either absolutely invisible or only seen when the luminous portion was in the line joining the earth and star: this explanation is sufficient for those which appear and disappear with regularity; in other cases this transitory phænomenon may merely indicate an epoch of change in the cosmogony of the peculiar system of the star.

Astronomy did not however engross all the attention of Galilei. He read and admired Gilbert's work, 'On the Nature of Bodies,' and adopted his views on the subject of terrestrial gravity, and constructed magnets after his example; about the same time he attacked with some bitterness one Capra, who ascribed to himself the invention of a species of compass which Galilei had made; and he wrote also on practical methods for the measurement of heights and distances. Shortly afterwards he states in a letter, that 'he intended hereafter to write three books on the system of the universe; three books on local motion; three books of mechanics; also on sound, speech, light, the tides, continuous quantity, animal motion, and castrametation; many of which, it is supposed, were destroyed by his relatives after his death, at the instance of the family confessor.

The year 1609 was signalized by the construction of the Galilæan telescope, which consisted of a plano-convex object-glass, and a plano-concave eye-glass, and thus he laid the foundation of the brilliant discoveries in the solar system, which have rendered that science the most perfect of which the objects are the most remote. It is true that Jansen, a Dutch optician, and some others previous to him, had constructed microscopes, and perhaps imperfect telescopes, but they cannot claim the invention of the astronomical telescope, their articles having been more intended for toys and puerile amusement than any valuable practical purpose; and as they had no notion of applying them to the heavenly bodies, it is obvious that their random constructions would be totally inapplicable to such a purpose. However the long-mooted question of the invention of this noble instrument of science may be decided, its application by Galilei to astronomy, for the first time, is indisputable. His first telescope was presented to the Doge of Venice, by whom the professorship at Padua was confirmed to him for life, with the greatest salary which had ever been there given to the mathematical professor, viz., about 1000 florins.

Galilei, impatient to obtain ocular evidence of what he called the 'structure of the universe,' soon provided himself with a second instrument, and on directing it towards the moon, this luminary became immediately stripped of the character of geometrical perfection, absurdly attributed to all the celestial bodies by the schoolmen, according to whom they were all perfectly round, self-luminous, and uncorrupted by any terrestrial tarnish.

The more obscure parts of the lunar surface, which they imagined had arisen from some earthly taint consequent on the proximity of the moon, being now rendered distinctly visible, taught Galilei that the surface of the moon was irregular and uneven, having mountains and valleys of much greater extent, in proportion, than those on our globe; the faint light on the darkened portion of the moon's surface he recognised to be the reflection of the sun's rays from the earth; the luminous isolated points near her inner border, and the jagged outline of that border, showed the great inequalities on her surface, since the mountain-tops would be illuminated by the sun, while the sides and base would lie in obscurity, in consequence of the convexity of the surface. In pursuing these observations, he found that the moon turns towards the earth the same face constantly, so that nearly a hemisphere of her surface can never be visible to us. From this remarkable fact he does not appear to have drawn the inevitable consequence, that the time of her rotation round her own axis, and the time of a revolution round the earth, must be exactly equal. Lagrange afterwards suggested that this effect was primitively caused by the determination of the lunar figure, in which the heavier part being originally accumulated towards the attracting primary, the moon, in its revolution, would always have a tendency to fall towards the heavier side so determined. Galilei subsequently observed the librations of the moon, by which small portions of her more distant hemisphere are alternately brought in view; but he was not in a situation to give a satisfactory explanation of the cause, from the imperfection of theoretical astronomy. The idea which was suggested from the appearance of oceans and continents, mountains and valleys, on the moon, that she might be habitable, overwhelmed the schoolmen with horror, and struck the religious with alarm.

On examining the nebulæ, and particularly the Milky Way, with his glass, he perceived that they were composed of myriads of stars, or, in the language of Milton, 'powdered with stars.' It may be remarked in passing, that Milton visited Galilei, and entertained the highest opinion of his philosophy, to which he makes several beautiful allusions in his 'Paradise Lost.'

The planet Jupiter furnished matter for still greater wonder. Galilei perceived three very small stars eastward of the planet, and close to its disc; two of them, on a subsequent observation, had distinctly changed position to the westward: he soon perceived that they were satellites; and shortly afterwards he discovered the fourth. The strength which this discovery gave to the Copernican system, from the analogy with our moon, however gratifying to Galilei in a speculative point of view, did not prevent his ever-active mind from perceiving its great practical importance in the question of determining longitudes at sea; but it was reserved for a future age to bring this and other methods to a degree of perfection then impracticable. The theory of astronomy and the construction of chronometers were, at that time, in a most imperfect state; and though Galilei offered his services to Spain, then a great maritime power, it is doubtful whether he would not have had cause for regret if the wished-for arrangement had taken place. The manner in which he was assailed after this discovery must have caused him amusement rather than chagrin: some would not look through his glass to be convinced; one Horky asserted that he had used the telescope, and that he saw nothing of the kind; one thought it odd that nature should give satellites to Jupiter for no purpose but to immortalize the Medici family (for Galilei had denominated them Medicean stars, in honour of his patron). Some time after, his opponents found out five satellites for Jupiter instead of four: while one had the impudence to say that he actually saw nine satellites. (1610.)

On examining Saturn with the telescope he perceived his ring, or rather rings (as Sir W. Herschel has since shown), but viewing it in perspective, he took the lateral portions for two small stars, which induced him to announce in transposed letters the following sentence —

'Altissimum Planetam tergeminum observavi.'
(The most distant planet I have observed to be threefold.)

Huyghens was the first who corrected this error; though it is remarkable that the occasional disappearance of the supposed lateral planets, which arose from the relative

change of the position of the ring, which so much astonished Galilei, had not suggested to him the correct nature of the phænomenon: we must however remember the great imperfections of the first-constructed telescopes.

His next discovery he also concealed in the same enigmatical manner; the transposed letters signify, in their proper order—

'Cynthiæ figuras æmulatur mater amorum;'
(Venus rivals the moon's phases;)

alluding to the crescent form of this planet when in or near conjunction. His discovery of spots on the sun's disc, which were evidently attached to that luminary, was a severe blow to the imaginary perfection of the schoolmen.

The Jesuits had always entertained a cordial hatred for Galilei, as he had joined the party by whom they had been expelled from Padua; the progress of his discoveries was therefore reported to the Inquisition at Rome, as dangerous to religion, and he was openly denounced from the pulpit by Caccini, a friar. In his own justification he wrote letters, one to his pupil Castelli, and another to the archduchess Christina, in which he repudiates any attack upon religion, and states that the object of the Scriptures was to teach men the way of salvation, and not to instruct them in astronomy, for the acquiring of which they were endowed with sufficient natural faculties. Nevertheless the Inquisition was implacable, and ordered Caccini to draw up depositions against Galilei; but his appearance in person at Rome in 1615, and his able defence of his conduct, for a moment silenced his persecutors.

In March, 1616, the pope (Paul V.) granted Galilei an audience, and assured him of his personal safety, but positively required him not to teach the Copernican doctrine of the motion of the earth: Galilei complied, and left Rome in disgust. He had soon occasion to turn his attention again to Astronomy, for in 1618 there appeared no less than three comets, on which occurrence Galilei advised his friends not to conceive too hastily that comets are like planets, moving through the immensity of space, but that they may be atmospheric: his reasons for this, though ingenious, are fallacious, as are those which he afterwards gave for t causes which produce tides, which he attributes to the unequal velocities of different parts of the sea by reason of the combination of the rotatory and progressive motions of the earth, which at some points conspire together and at others are opposed. Wallis afterwards seems to have adopted the same opinion, which could never have been entertained had either of them reflected on the complete independence of the rotatory and progressive motions of bodies. The motion of the whole solar system too would, on their supposition, have affected the tides; but Dynamics had as yet no existence, and Galilei often frankly confesses that he is more a philosopher than a mathematician. He afterwards went to Rome, and was received with great kindness by the next pope (Urban VIII.): his enemies were silenced for awhile, and he was sent home to Tuscany loaded with favours and presents: and though his patron, Cosmo II. de' Medici, was dead, his successor, Ferdinand II., showed him strong marks of esteem and attachment.

In 1630 he finished, and in 1632 completed his celebrated work, 'Dialogue on the Ptolemaic and Copernican Systems,' which he dedicated to Ferdinand II. By giving the work this form, his object seems to have been to evade his promise not to teach the Copernican doctrines. Three fictitious persons conduct the dialogue: Salviati, a Copernican; Sagredo, a banterer on the same side; and Simplicio, a Ptolemaist, who gets much the worst both by jokes and argument. The pope, who had been personally friendly with Galilei, fancied that he was the person held up to ridicule in the last character, as some arguments which he had used had been put into Simplicio's mouth; he was therefore mortally offended, and the Inquisition resolved not to allow the attempted evasion of Galilei's solemn promise. Galilei was accordingly summoned to Rome, though he was 70 years of age and overwhelmed with infirmities; he had however all the protection and comforts which the Grand Duke could confer on him, being kept at the Tuscan ambassador's house, and this spirited man (Nicolini) even wished to maintain him at his own expense when he perceived a penurious disposition in Ferdinand's minister.

After some months' residence in Rome he was again summoned before the Inquisition, and on the 20th of June appeared before the assembled inquisitors in the Convent of Minerva. The whole of his sentence is too long to be transcribed here, but a portion of it is too curious to be omitted.

'By the desire of his Holiness and of the most eminent Lords Cardinals of this supreme and universal Inquisition, the two propositions, of the stability of the sun and motion of the earth, were *qualified* by the Theological Qualifiers as follows:—

1st. The proposition that the sun is the centre of the world and immoveable from its place, is absurd, philosophically false, and formally *heretical*; because it is expressly contrary to Holy Scripture.

2ndly. The proposition that the earth is not the centre of the world, nor immoveable, but that it moves, and also with a diurnal motion, is absurd, philosophically false, and theologically considered at least *erroneous* in faith.'

After a long and declamatory exposé, from one passage in which it has been suspected that Galilei was put to the torture, it concludes thus—

'We decree that the book of the Dialogues of Galileo Galilei be prohibited by edict; we condemn you to the prison of this office during pleasure; we order you, for the next three weeks to recite once a week the seven penitential psalms, &c. &c.'

To obtain so mild a sentence Galilei was obliged to abjure, on the Gospels, his belief in the Copernican doctrine. We quote a part of his abjuration:

With a sincere heart and unfeigned faith I abjure, curse, and detest the said errors and heresies (viz. that the earth moves, &c.); I swear that I will never in future say or assert anything, verbally or in writing, which may give rise to a similar suspicion against me. . . .

'I Galileo Galilei have abjured as above with my own hand.'

Rising from his knees after this solemnity, he whispered to a friend, 'E pur se muove:' 'It moves, for all that.'

This sentence and abjuration having been generally promulgated, the disciples of Galilei found it necessary to act with prudence, but their esteem for their master was not diminished by this compulsory abjuration

Afflictions followed quickly the old age of Galilei. In April, 1634, he lost a beloved daughter who was his only stay. He was allowed to return to Arce breathed her last, but he was still kept in strict confinement. After two years spent in this unhappy condition his confinement became more rigorous through some new suspicions entertained by the pope, so that after having been allowed to remove to Florence for the benefit of his declining health he was ordered to return to Arcetri. In 1636 he became totally blind, about which time he finished his 'Dialogues on Motion,' which were remarkable enough for the time for any other man, though not perhaps commensurate with the high ideas associated with the name of Galilei; and though he believed this work could not annoy the holy office, yet the terror was so great and universal that he could not get it published until some years after, when it was undertaken at Amsterdam.

Amongst the most celebrated pupils of Galilei are Viviani and Torricelli, the former of whom in particular bore a strong attachment for his master. While Torricelli was arranging a continuation for the 'Dialogues on Motion,' Galilei was suddenly taken ill with a palpitation of the heart, and, having lingered two months, he died on the 8th January, 1642.

He appears to have been of a sprightly temperament, easily crossed and easily reconciled; his kindness to his relatives, which distinguished him from his childhood to old age, and which went frequently to such an extent as to embarrass himself, forms a noble trait in his domestic character; he was somewhat attached to the bottle and was considered a good judge of wine; he contrived to have his son Vincentio legitimized, but afterwards had the misfortune to find his hopes in this lad rather disappointed. Galilei was also acknowledged to have an excellent taste for music, painting, and poetry, and the style of his 'Dialogues' is still much praised by his countrymen.

His works have been collected in 13 vols. 8vo., Milan, 1811; there have been also several other collections of the same, and they have been published in separate tracts.

Viviani, his disciple, wrote his life and left a legacy to raise a monument to his memory. Newton was born one year after Galilei's death.

One of the best-written biographies of Galilei that has yet appeared is by Mr. Drinkwater.

GALINUS. The reference to this word is a typographical error. It should have been GALIACEÆ, which see.

GALIPE'A, a genus of Rutaceous shrubby or arborescent plants, inhabiting the warmer parts of South America. Their leaves are often simple, occasionally 3-4-5-leafleted, not divided at the edge, covered with pellucid or glandular dots. The flowers are small, white or pink, often fragrant, in axillary, extra-axillary or terminal, racemes, corymbs, or panicles. The most remarkable species is the Galipea or Bonplandia trifoliata, which has also been called Cusparia febrifuga, and Galipea Cusparia, a plant yielding Angostura bark, a medicine employed as a febrifuge and in dysentery. It is found in the neighbourhood of Angostura on the Spanish Main.

GALIPEA. (Materia Medica.) The genuine Angostura or cusparia bark is obtained from a species of this genus, but whether from the G. cusparia, as stated by Humboldt, or by a distinct species, G. officinalis, as asserted by Dr. Hancock, is not determined. Angostura bark is obtained both from the stem and branches; the specimens from the stem are flat, from 2 to 3 lines thick, while those from the branches are often quilled, and from ½ to 1 line thick. The pieces are sometimes from 6 to 15 inches, but more frequently only from 2 to 6 inches long, and from ½ to 2 inches broad. Some specimens have the surface covered with a thick, fungus-like, whitish-yellow or clay-coloured crust, which may be more or less easily scraped off, and beneath which is a yellowish-red smooth bark, often exhibiting small cracks. Other specimens have this covering much thinner and closely adhering to the bark. The internal surface is generally smooth, of a tawny or reddish-yellow colour.

The bark is easily broken, and the recent fracture is of a brownish-red colour, smooth, with a resiny shining surface. The shining appearance is best seen when a transverse section is made with a sharp knife. The smell is disagreeable: the taste pleasantly bitter, warm, aromatic, and causing a flow of saliva. The powder has the colour of rhubarb. The infusion is of an orange-yellow colour; the decoction a clear light brown.

Brandes thought that he had discovered an alkaloid, which he proposed to call Angosturin, but it has not been detected by subsequent chemists. This bark contains neither gallic acid nor tannin. According to the analysis of Fischer it consists of—

Volatile oil (of an acrid nature)	0·3
Bitter hard resin	1·7
Balsamic soft resin	1·9
Elastic resin	0·2
Bitter matter (Angosturin bitter)	3·7
Gum	5·7
Woody fibre	89·1
	102·6

So minute an account of this substance would not be necessary, were not the true Angostura bark liable to be confounded with the false, which possesses such poisonous properties that very fatal consequences have resulted from the substitution of the one for the other. It is probable that the false is the bark of some species of South American strychnos, as it contains strychnia as well as brucia [BRUCIA], two most potent alkaloids. The idea that this spurious bark is obtained from the Brucea ferruginea is entirely unfounded, as that tree grows in Abyssinia, and the false Angostura bark comes mixed with the genuine, and not as an isolated or distinct commercial article.

False Angostura bark was first observed in 1804 by Dr. Rambuch, of Hamburg, by poisonous effects following the use of a decoction of the bark; and similar consequences having been observed at Vienna, the Austrian government ordered all the Angostura bark in the empire, genuine as well as false, to be burnt, and interdicted its future importation. The Russian and Würtemberg authorities made known the danger, and published the marks of distinction, which are sufficiently characterized, and to prevent accidents, may be here enumerated.

Genuine.	*Spurious.*
Pieces 2 to 4 inches long; from ½ to 2 inches broad; from ¼ to ¾ of a line thick.	Pieces of greater breadth than length; thickness never less than a line, often two lines.
Epidermis having on it a number of different lichens (often as many as 40 species), and a yellow membranous crust.	Epidermis generally clear (but sometimes undergoing a peculiar transformation), and seldom having any, or not more than two lichens (Opegrapha Pelletieri, and Pyrenula nitida).
The incrustation spongy and insipid, and not changing colour by the action of nitric acid.	The crust has the general properties of the bark, and assumes a deep green by the action of nitric acid. It contains a resinous colouring principle, Strychnochromin.
Crust easily removed by the nail.	Crust not easily removed.
Inner surface yellow, and separable into layers.	Inner surface brown, or even black, not separable into layers.
Texture not close, weight light, easily broken, fracture even, shining, and resinous. Cuts transversely without difficulty.	Texture compact, heavy, not easily broken, fracture even, but not shining or resinous, exhibiting two layers. Very difficult to cut.
Placed in water it soon imbibes it, and becomes soft.	Scarcely softens in water.
Smell strong and disagreeable.	No smell.
Taste an aromatic and enduring bitter, but not at all disgustingly bitter.	Taste in the highest degree disgustingly bitter: very durable, and not at all aromatic or astringent.

Re-agents produce the following effects on a cold infusion of each:—

Colour of infusion of genuine, orange yellow. *Colour of infusion of spurious, light yellow.*

Cold Infusion.	Tincture of Galls.	Bi-chloride of mercury.	Sulphuric Acid.	Proto-sulphate of iron.	Perchloride of iron.	Carbonate of potass.
Genuine Angostura.	Yellowish precipitate.	Copious precipitate.	Very turbid.	Whitish-grey precipitate.	Yellowish brown precipitate.	Dark red colouring, with slight precipitate.
Spurious Angostura.	White precipitate.	Renders turbid only.	No action.	Green colour, slightly turbid.	Yellowish green colour.	Greenish colouring, with dirty yellow precipitate

Spurious Angostura bark, in the dose of eight grains, killed a dog in two hours; ten grains killed a young dog in a few minutes. A very small glassful of an infusion endangered the life of an adult, while a dose of the decoction destroyed a child with acute suffering. Æther and laudanum seem to act as antidotes. The dread of similar casualties from the employment of the spurious instead of the genuine Angostura bark, has prevented the use of the latter to that

extent which it merits. In the treatment of the bilious diarrhœa, frequent in damp autumns in this country, after proper evacuants, it is of the most decided utility. In common English cholera likewise, and slighter cases of Asiatic cholera, it is the most beneficial agent which can be resorted to. It is best given in the form of infusion, and may either be administered alone, or with the addition of dilute nitric acid and tincture of opium, which last may be discontinued after a few doses. (Abercrombie, *On Diseases of the Stomach, &c.*)

GALL, ST., THE CANTON OF, one of the cantons of the Swiss Confederation, situated at the north-east extremity of Switzerland, is bounded on the north by the canton of Thurgau and the lake of Constance; east by the Austrian province of the Vorarlberg; south by the cantons of Grisons and Glarus, and west by those of Schwyz and Zürich. Its area is reckoned at 780 square miles, and its population, which has been rapidly increasing for the last twenty years, amounted in 1831 to 165,740 inhabitants, of whom 62,500 were Protestants and the remainder were Catholics. St. Gall is a new canton, which was formed at the beginning of the present century by the union of the territories of the Abbot of St. Gall with the free town of St. Gall, and several districts formerly subject to the old cantons, namely, the Rheinthal, Sargans, Werdenberg, Utznach, Gaster, and Sax, and the town of Rapperschwyl. By the agglomeration of so many various districts which happened to be situated all round the old canton of Appenzell, that canton is now enclosed on every side by the territory of St. Gall. (APPENZELL.) The spoken language of St. Gall is a dialect of the German, resembling the Swabian.

The canton of St. Gall is in great part a mountainous country, being intersected by various offsets of the Alps, the highest of which are continuations of the great chain which bounds on the north the valley of the Upper Rhine in the Grisons country, and which on entering the territory of St. Gall at the summit called Scheibe (9000 feet) divides into three branches, one running north along the frontiers of Glarus as far as the south bank of the lake of Wallenstadt, another eastwards between St. Gall and the Grisons, forming the summit called Galanda (8800 feet high) and the third extending north-east into the canton of St. Gall, between the rivers Tamina and Seez. North of the lake of Wallenstadt is another chain running in a north-west direction, which divides the basin of the Linth from that of the Thur, and contains several summits between 6000 and 7000 feet high. North of the Thur and between it and the lake of Constance is another extensive group of mountains, known by the name of Alpstein, which cover nearly the whole of Appenzell, and extend also into the adjacent districts of St. Gall. The general slope of the surface is towards the north and north-west, the streams running in those directions. The principal rivers are: 1. the Rhine, which coming from the Grisons touches the canton of St. Gall near Pfäffers, and flowing northwards forms its eastern boundary for a length of about fifty miles, dividing it first from the Grisons, and afterwards from the Vorarlberg, until it enters the lake of Constance below Rheineck. Its principal affluent in the canton of St. Gall is the Tamina, a rapid Alpine stream which rises in the Scheibe, crosses the south part of the canton, passes by Pfäffers, and enters the Rhine below Ragaz. 2. The Seez, which rises also in the south part of the canton, runs first north-east and then north-west, and enters the lake of Wallenstadt. 3. The Thur, which rises in the central part of the canton near Wildhaus, Zuingli's birth-place, runs northwards through part of the fine district of Toggenburg, passes by Lichtensteg, receives the Necker on its right bank, and after a course of about forty miles enters the canton of Thurgau near Bischofszell. 4. The Sitter, which coming from the canton of Appenzell, passes near the town of St. Gall and enters Thurgau, where it joins the Thur. 5. The Goldach, which rises also in Appenzell, and runs into the lake of Constance. The north and north-west districts of the canton towards the borders of Thurgau are mostly level, as well as the banks of the Linth, between the lakes of Wallenstadt and Zürich, where an extensive marsh has been drained by means of the canal of the Linth.

The agricultural produce of the canton consists chiefly of wine, fruits in great abundance, especially apples and cherries, some corn, Indian corn, potatoes, and pastures. There are considerable forests in the southern part of the canton, and much wood is exported. The domestic animals are oxen, sheep, goats, pigs, and horses; the rivers and lakes abound with fish and water-fowl. There are rich iron-mines at Gunzenberg; and coals and turf are found in several districts. Manufactures constitute an important branch of industry. Ever since the thirteenth century the town of St. Gall was known for its linen manufactories, which now have been replaced by those of cotton goods and especially muslins. In 1828, 124,000 pieces of muslins and other cotton goods were manufactured in the canton. The women are also employed in embroidery, for learning which there is a gratuitous school for poor girls. The tanneries have fallen off of late years, the people now preferring to export raw hides. About 3000 bullocks' hides and 2000 goats' skins are exported annually. The town of St. Gall is a place of great trade, especially with Germany and Italy, and contains some wealthy merchants, manufacturers, and bankers or bill-brokers.

The canton is divided into fifteen districts, namely: St. Gall, Tablat, Rorschach on the banks of the lake of Constance, Unter Rheinthal, Ober Rheinthal, Werdenberg, Sargans, Gaster, See Bezirk on the banks of the lake of Zürich, Ober Toggenburg, Unter Toggenburg, Alt Toggenburg, Neu Toggenburg, Wyl, Gossau. The finest districts are the Rheinthal, Rorschach, St. Gall, Wyl, the greater part of the Toggenburg, and the See Bezirk; the remaining or southern districts are mountainous.

St. Gall, the capital of the canton, once a free imperial city, and afterwards an ally of the old Swiss cantons, is situated in a pleasant valley, is well built, well supplied with water, and contains above 400 houses within the walls, and 8900 inhabitants, of whom 1230 are Catholics. The principal buildings are, the old Abbey Church, one of the finest in Switzerland, with handsome paintings: the former convent, now a gymnasium; the Casino or assembly-room, the town-house, several hospitals and asylums, and the public granaries. The old Abbey library has above 1000 MSS., many of them valuable; several of the classics which were considered as lost, were discovered in the middle ages in this library by Poggio Bracciolini and other philologists. St. Gall is one of the most commercial towns of Switzerland; but its inhabitants are likewise fond of the sciences and literature, as appears from the existence of numerous societies, private libraries, collections of natural history, and other similar establishments within the town. The environs are embellished with numerous country-houses and promenades. St. Gall is forty miles east of Zürich, and forty-five miles north of Coire in the Grisons. Rappertswyl is prettily situated on a peninsula projecting into the lake of Zürich, with a bridge 4500 feet long, which crosses over to the south bank of the lake; it has some manufactories and about 1500 inhabitants. Altstätten in the upper Rheinthal, in the midst of a fertile country, is a place of some trade, with about 6000 inhabitants, including its commercial territory. Rheinek in the lower Rheinthal, on the left bank of the Rhine, which separates it from the Austrian territory has about 1400 inhabitants: the red wine made in the neighbourhood is among the best in Switzerland.

The government of St. Gall is a democracy. The members of the Great Council or Legislature are chosen in their respective districts by all the citizens above twenty-one years of age, except those who are supported by the public charities, bankrupts, and those whose immoral conduct is attested by legal proof. The members are elected for two years. The Great Council appoints from among its body the members of the Little Council or Executive for four years. It also appoints those of the Criminal Court and of the Court of Appeal. The citizens of each district appoint every year their own amman or prefect, and other local authorities. All the laws emanating from the Great Council are subject to the sanction of the electors of the various communes, if they choose to exercise their right within forty-five days after the passing of the law: that period being expired without any objection made by the majority of the communes, the law becomes in force. All absent electors are considered as voting in favour of the law. The constitution of St. Gall is one of the most democratic among the representative cantons of Switzerland: it approaches nearly to that of the landsgemeinde or pure democracies of the little cantons. This constitution dates from 1831, when, being laid before the communal assemblies for their sanction, the number of citizens having the right of voting being 32,980, it was negatived by 11,097, and approved of by 9,253, to which latter number was added that of 12,630, who were absent, and

who were considered, according to a clause in the project of the constitution itself, among the ayes.

The revenues of the state derived from the income-tax, licenses for shops, public-houses, and sporting, stamp-duties, tolls, monopoly of salt, post-office, and national domains, amounted in 1835 to 305,597 florins, and the expenditure of the same year was 274,054 florins. Each of the two religious communions in the canton administer their own affairs. The Catholics have a Board of Administration; the property of their church is 1,627,776 florins, and they have four convents of monks and ten nunneries. They were formerly under the diocese of the bishop of Coire and St. Gall; but in 1833, on the death of the last bishop, the Catholics of St. Gall refused to acknowledge his successor, appointed by the pope; the Grisons likewise demanded the separation of their diocese from that of St. Gall; and after much discussion, the pope, in 1836, decreed the dissolution of the double bishoprick, and appointed an apostolic vicar to superintend the ecclesiastical affairs of St. Gall and Appenzell. The abbot of St. Gall has long since lost all his domains and revenues, and the convent has been suppressed. A pension was offered to the last abbot, Pancratius, in 1814, which he refused, and claimed the restoration of his former rights. Having endeavoured in vain to interest the Allied powers in his favour, he retired to the convent of Müri, in the canton of Lucerne. (Lereshe, *Dictionnaire Géographique Statistique de la Suisse*; Walsh, *Voyage en Suisse*; Franscini: Dandolo.)

GALL, DR. FRANZ JOSEPH, the founder of the system of phrenology, was born at Tiefenbrunn, in Suabia, on the 9th of March, 1757. He seems at a very early age to have evinced habits of accurate observation, for it is said that, when a boy at school, he often amused himself with remarking the differences of character and talent among those educated alike, among his brothers and sisters, and his playmates and schoolfellows. He saw, too, that these characters seldom changed—that education rarely altered the good or bad temper of a child, or gave the talent which he exhibited in one subject a direction towards another. He observed that the boys who were his most formidable competitors were all distinguishable by a peculiar expression of countenance, the result of unusual protrusion of the eye-ball, which seemed to him a certain sign of talent. On his removal to another school he still found himself invariably beaten by his 'bull-eyed' companions, as he called them, and making the same observations as before, he found all his playmates still distinguished for some peculiar talent or temper. He next went to the university of Vienna to pursue his studies for the medical profession, and at once began to search for prominent eyes among his fellow-students; all that he met with were, as he found, well known for their attainments in classics, or languages generally, or for powers of recitation; in short, for talent in language; and hence the sign of a prominent eye, which he had first thought indicated talent generally, he became convinced marked a facility for acquiring a knowledge in words, which was the principal study in the schools of his boyhood. This coincidence of a peculiar talent with an external physiognomic sign, led him to suspect that there might be found some other mark for each talent, and remembering that at school there were a number of boys who had a singular facility in finding birds' nests, and recollecting where they had been placed, while others, and especially himself, would forget the spot in a day or two, he began to search among his fellow-students for all who indicated a similar knowledge and memory of places, that he might see in what feature that would be indicated, and he soon thought he found them all marked by a peculiar form of the eye-brow. He now felt convinced that by accurate observation of the shape of the head in different persons, he should find a mark for every kind of talent, and he lost no opportunity of examining the forms of the head in poets, painters, mechanics, musicians, and all distinguished in art or science. He found external signs in each class that separated them from the rest, and he thought he could now clearly discern the character of each by their cranial formation before he inquired into their pursuits or reputation. He had observed that persons remarkable for determination of character had one part of their heads unusually large, and he was therefore led to seek whether there were not signs of the moral affections similar to those which he believed he had discovered to indicate the intellectual powers. After some time he found that these affections also might be ascertained by discerning how far one portion of the head surpassed the others in size. His mind was so completely engrossed with the pursuit of facts to support his belief that he should find a complete key to the human character, that his academic career was marked by no particular success, though his talents might certainly have secured it.

To further his pursuit, he now resorted to the works of the most esteemed metaphysicians of antient and modern days, but here he found little besides unsatisfactory theories, and contradictions of each other, and certainly nothing that at all favoured the view which he had been led to take of the human mind. He therefore gave them up, and resorted again to the observation of nature alone, and he now extended his field. Being on terms of intimacy with Dr. Nord, physician to a lunatic asylum in Vienna, he carefully examined all the insane there, observing the peculiar character of the insanity in each, and the corresponding forms of their heads: he frequented prisons and courts of justice, and made notes of the crimes and appearance of all the prisoners. In short, wherever there was any person made remarkable by good or bad qualities, by ignorance, or by talent, Dr. Gall lost no opportunity of making him a subject of his study. With the same views he was constant in his study of the heads and characters of both wild and domesticated animals. He had always felt sure, that the form of the skull in itself alone could stand in no relation to the intellect or disposition, but it was not till late in his pursuit that he resorted to anatomy to confirm his views. Having obtained his diploma, he made it his care, as far as possible, to ask for leave to examine the brains of all whose characters and heads he had studied during life, and soon found that, as a general rule, the exterior of the skull corresponds in form with the brain contained within it.

At length, after unremitting exertion, and constant study for upwards of twenty years, Dr. Gall delivered his first course of lectures, in 1796, at his house in Vienna. Supported by a vast accumulation of facts, he endeavoured to prove that the brain was the organ on which all external manifestations of the mind depended; that different portions of the brain were devoted to particular intellectual faculties or moral affections; that, *cæteris paribus*, these were developed in a degree proportioned to the size of the part on which they depended; and that, the external surface of the skull corresponding in form with the surface of the brain, the character of each individual was clearly discernible by an examination of his head.

A doctrine so new, and so subversive of all that had been previously taught in psychology, produced no little excitement. To some the number of simple facts, the apparently clear and necessary deductions from them, and the ease with which the new system seemed to lead to the knowledge of a science hitherto so obscure, were sufficient to secure at once their assent, while others said that Gall, beginning with a theory, had found at will facts to support it; that a plurality of powers in the same organ was too absurd to be imagined, and that the doctrine, leading on the one hand to fatalism, on the other to materialism, would, if received, be subversive of all the bonds of society, and opposed to the truths of religion. It was argued with all the ardour with which new doctrines are so generally assailed and defended, but Gall took little part in these disputes, and still continued to lecture and collect more facts.

He gained disciples daily, and in 1800 Dr. Spurzheim became his pupil. In 1804 this gentleman was associated with him in the study of his science, and to this fortunate event phrenology probably owes much of its present clearness and popularity. Spurzheim possessed a mind peculiarly adapted for generalizing facts, of which the science at that time almost entirely consisted, and besides being most ardent and industrious in the pursuit of additional support for the doctrines, he had a suavity of manner and a brilliancy of conversation which prepossessed all in favour both of himself and his science. It is from him indeed that nearly all the knowledge of phrenology at present current in England has been derived; for till his arrival here in 1814, and the publication of his 'Physiognomical System' in 1815, nothing was known of the science except from a small translation of a German treatise in 1807, and some very unfavourable notices of it in periodicals. Since that time too the smaller size and more popular style of his books have made them far more generally known than those of his preceptor, and a large majority of the phrenologists of this country are entirely of the school of Spurzheim.

Soon after their association, Drs. Gall and Spurzheim

commenced a tour through the principal towns in Germany and Switzerland, diffusing their doctrines, and collecting everywhere with the most assiduous industry fresh evidence in their favour. In 1807 they arrived at Paris, which became at once the field of their principal labours, and of the most vehement discussion. Amongst many, it attracted the attention of Napoleon, probably from the extensive practical benefits which it was urged would flow from it. At first he is said to have spoken in no measured terms of the savans of his country, for 'suffering themselves to be taught chemistry by an Englishman (Sir H. Davy), and anatomy by a German.' He afterwards however expressed his disbelief in it, and hence the reason (say the most ardent supporters of the doctrine), why in 1809 the commission appointed by the Institute on the Memoir presented by Gall and Spurzheim, in March 1808, returned a report highly unfavourable to the science and its author. Undaunted however by this severe check to their rising popularity, they continued to study and to teach both by lectures and by voluminous publications till 1813, when a dispute arising, partly as to the degree of credit which each merited for the condition at which the science had then arrived, partly from private motives, they separated. Dr. Gall remained in Paris; Dr. Spurzheim soon after proceeded to England, where he continued for several years lecturing in London and the principal towns of the kingdom, and whence he ultimately proceeded to America.

Dr. Gall continued in Paris till his death, which occurred on the 22nd of August, 1828.—He had suffered for nearly two years previously from enlargement of the heart, which prevented him, except at intervals, from pursuing his lectures, and at length produced a slight attack of paralysis, from which he never recovered. At the post-mortem examination his skull was found to be of at least twice the usual thickness and there was a small tumour in the cerebellum: a fact of some interest, from that being the portion of the brain in which he had placed the organ of amativeness, a propensity which had always been very strongly marked in him.

Whatever may be the merits of the phrenological system, Dr, Gall must always be looked upon as one of the most remarkable men of his age. The leading features of his mind were originality and independence of thought; a habit of close observation, and the most invincible perseverance and industry. Nothing perhaps but a character like this in its founder, and the very popular and fascinating manners of his chief supporter, could have upheld the doctrine against the strong tide of rational opposition and of ridicule with which it was assailed. Whether the system be received or not, it will be granted, that both in the collection of psychological facts which they had formed, and have published, and by the valuable contributions which they have made to the study of the structure of the brain, to which their later labours had been particularly directed, they have conferred very great benefits on medical science. The character of Dr. Gall's writings is singularly vivid and powerful; his descriptions, though slight, are accurate and striking, but his works are too voluminous to be acceptable to the majority of readers, and have therefore, in this country, been almost entirely superseded by those of Dr. Spurzheim, to which however, in substantial value, they are far superior. They comprise 'Philosophisch-Medicinische Untersuchungen über Natur und Kunst im Kranken, und Gesunden Zustande des Menschen,' 8vo. Leipzig, 1800; 'Anatomie et Physiologie du Système Nerveux en général, et du Cerveau en particulier: Mémoire presenté a l'Institut, Mars, 1808;' and under the same title his great work in 4 vols. 4to., and atlas folio, published in Paris, from 1810 to 1819, of which the 1st and half the 2nd volume were written in conjunction with Dr. Spurzheim; and 'Sur l'Origine des qualités morales et des Facultés intellectuelles de l'Homme,' 6 vols. 8vo., Paris, 1825. An English translation of them has lately been published in America by Nahum Capin, and another of the 4to. work is said to be in progress in England.

GALL. [Bile.]

GALL STONES. [Calculus.]

GALLATES. [Gallic Acid.]

GALLEON (*galoion* in French, *galen* in Spanish) was the name given to very large ships, with three or four decks, which the court of Spain used to send at fixed periods to the coasts of Mexico and Peru, to receive on board the gold and silver bullion extracted from the mines, and bring it to Spain. Commodore Anson intercepted, and captured after a short engagement, one of these galleons on its way from Acapulco to Manilla, [Anson.]

GALLERY, in its most extended sense, is used synonymously with corridor. [Corridor.] In England however it is understood to be either a long narrow passage-way, or an open space, generally longer than wide, raised above the floor of a building, and usually supported on columns. Such galleries are met with (among other places) in English churches, in some courts of justice, and in theatres. The long external wooden passage-ways, formed something like a balcony, such as are occasionally seen in old inns, are called galleries. The antients also had their galleries in their basilicæ [Basilica] and in their agoræ. [Forum.] The crypto-porticus was a gallery. The term gallery is also applied to a long room, or a series of rooms containing pictures, as the gallery of the Louvre at Paris.

GALLERY, in military mining, is a subterranean trench, or passage, leading to the place where the powder is deposited for the purpose of producing an explosion.

Of the galleries which appertain to a fortress, the principal one, denominated the magistral gallery, surrounds the place under its covered-way; and the entrances to it are in the counterscarp of the ditch. A second gallery, designated the envelope, is formed under the foot of the glacis, so as either wholly or partially to circumscribe the works; and galleries of communication under the glacis lead to it from the former gallery. Small galleries, sometimes called listeners, are also carried towards the country, from the envelope; in order, as the name implies, that the defenders in them may discover, by the sound, where the enemy's miner is at work.

The galleries of a fortress are at least six feet high and four feet wide, and are lined and vaulted with brick work: they are, or should be, so disposed as to ensure complete drainage: and means must be provided to afford them proper ventilation. At the places where they intersect one another are formed enlargements in which tools may be deposited, and the miners, with their barrows, be enabled to pass each other: verticle grooves are also cut down the sides of a gallery for the reception of the ends of timbers which may serve to barricade it; and at the places where the galleries of communication fall into the envelope are placed strong doors, with loop-holes through them, for musketry, in order to arrest the progress of an enemy, should he force an entrance into the latter.

The most proper place for the magistral gallery does not appear to be precisely determined. Some engineers form it close to the counterscarp, so that the wall of the latter serves for one side of the gallery; by this disposition considerable expense is saved, and complete ventilation may be easily obtained by means of loopholes opening into the ditch. But as, in this situation, the enemy, having penetrated into the gallery, might direct a fire through the loopholes, and might easily form a passage into the ditch by destroying the counterscarp wall, others prefer that it should be executed under the banquette of the covered-way.

A continuous gallery surrounding the place under the foot of the glacis is objectionable on account of the certainty that, in some part of its length, it will be met and destroyed by the working parties of the besiegers: it is therefore preferable that at the extremities of the galleries of communication before mentioned there should be executed short portions only of an envelope gallery; from which portions the listeners may be carried towards the front. The galleries leading from the magistral to the envelope are nearly parallel to, but they ought not to be immediately under, the ridges and gutters of the glacis, lest those lines should serve the enemy as indications of the positions of the galleries, and enable him easily to find them; and as a man working under ground may be heard at a distance of ninety feet from him, it follows that the listening galleries ought not to be more than twice that distance from each other, lest the enemy's miner should pass between them unperceived.

The roofs of galleries may be from fifteen to twenty feet below the level of the natural ground.

The galleries executed by the besiegers are usually carried out from a shaft sunk vertically in the ground; and they are either parallel or inclined to the horizon, according to circumstances. When the soil is loose the sides and roof are lined with planks, which are retained in their places by rectangular frames of timber placed at intervals from each other across the gallery; and it is recommended that the frames should be perpendicular to the direction of the length of the gallery, even when the latter is inclined to the horizon.

The galleries of the besiegers are usually four feet six inches high, and three feet wide; and when their length exceeds 150 feet, the air in them being unfit for respiration, it becomes necessary to ventilate them by bellows or otherwise. [MINE, MILITARY.]

GALLEY (*galère* in French, *galèra* in Italian and Spanish), a large-sized vessel propelled by oars and sails, which was much in use in the Mediterranean until the end of the eighteenth century. It carried two masts with lateen sails, was long and narrow, and drew but little water; it was therefore calculated for coast navigation, and for making the shore in shallow water; and by means of its oars it had a great advantage, in the dead calms so frequent in the Mediterranean, over sailing vessels, an advantage in which it has been effectually superseded by the introduction of the steam-boat. Even long before that invention the use of galleys as a naval force had been given up by France, their construction rendering them unfit for long navigation, and for encountering the waves of the ocean. The Knights of Malta, Naples, the Pope, and other Italian states, were the last to continue the use of galleys for the purpose of coping with the Barbary privateers, whose vessels, although of a similar description, were generally smaller and unable to resist the large and well-disciplined galleys of the Christian powers. The largest galleys were 166 feet long and about 32 wide, with 52 oars. The rowers, who were generally convicts or Turkish prisoners, with chains to their feet, sat on benches on the deck. The ship carried a 24-pounder and two 8-pounders. (See a description and plate of a large-sized galley in the *Dictionnaire de Marine*, article *Galère* in the *Encyclopédie Méthodique*.)

The galleys appear to have been an imitation of the antient triremes, and they retained the antient names for several parts of the rigging, such as 'antenna,' &c. The felucca is a kind of small galley. [FELUCCA.] The Venetians had a sort of large galleys, with a very lofty poop, called 'Galeazza.'

GALLEY SLAVES (*galériens* in French, *galeotti* in Italian), is the name given to criminals condemned to hard labour, who formerly used to be employed as rowers on board the galleys, but now are employed chiefly in the docks and military harbours of France, Spain, and Italy, where they exhibit an assemblage of misery, filth, and vice which is a reproach to the criminal legislation of those countries. [BAGNIO.]

GALLIA. [FRANCE.]

GALLIARD (*Gagliarda*, Ital.), a lively dance in three-crotchet time, which had its origin in Rome, but has fallen into disuse.

GALLIC ACID was the last discovery of Scheele. It exists in most astringent vegetables, but principally in the gall-nut, and hence its name. In this it is mixed with ellagic acid, and with tannic acid, or the tanning principle. Many processes have been proposed for obtaining gallic acid: the simplest is that of reducing galls to coarse powder, and digesting them in about four times their weight of water for several days. The strained solution, when exposed to the air, deposits the gallic acid in small crystals in a short time, and continues to do so for a considerable period. A large portion of the acid exists ready formed in the gall-nut, and by some substance which appears to act as a kind of ferment a further portion of the acid is also formed by the action of the air. It has indeed been supposed that the tannic acid is by oxidation converted into the gallic, and from this source more of the gallic acid may probably be formed. The crystals are sometimes perfect though small, and of a brown colour; they are rendered perfectly colourless by digesting and dissolving in hot water with animal charcoal, which has been treated with hydrochloric acid to dissolve its phosphate of lime; when the colourless solution is sufficiently evaporated, slender prismatic colourless crystals are obtained, the primary form of which is an oblique rhombic prism. The taste of gallic acid is slightly sour and astringent: the solution reddens litmus paper. When exposed to a temperature of above 250° the crystals lose their water and effloresce. Gallic acid is soluble in about 100 times its weight of cold water, and very soluble when it is boiling; it dissolves also in alcohol and in æther.

Gallic acid combines with bases to form salts, which are termed *gallates*; these will be considered, when important, under their respective bases; we merely add that on protosulphate of iron it has scarcely any action, but with the persulphate of iron it produces a deep blue-black precipitate, which is the principal colouring matter of writing-ink. The gallates of ammonia, potash, and soda are soluble in water; but most of the metallic gallates, strictly speaking, are insoluble: gallic acid in the form of tincture of galls is much employed as a chemical *re-agent*; but part of its effect is owing to the presence of tannic acid, which is well known to precipitate solutions of albumen and gelatin, which gallic acid, when pure, does not.

Anhydrous gallic acid, according to Pelouze, is composed of

Three equivalents of	Hydrogen	. . .	3
Seven „	Carbon	. . .	42
Five „	Oxygen	. . .	40
	Equivalent		85

In the crystalline state it contains water, and is composed of

One equivalent of	Anhydrous Gallic Acid .	85
One „	Water	9
	Equivalent	94

When gallic acid is heated it is, as already noticed, rendered anhydrous, but at higher temperatures it is converted into PYROGALLIC ACID and MELOGALLIC ACID. At a red heat it is decomposed and totally dissipated.

GALLI'COLÆ, a family of Hymenopterous insects of the section Pupivora. Distinguishing characters:—posterior wings having but one nervure; anterior wings with two brachial cells, a radial cell of a triangular form; two or three cubital cells, of which the second (where there are three) is very small, and third large and bounded by the apical margin of the wing; antennæ of equal thickness from the base to the apex (or with the latter portion slightly thickened) and consisting of from thirteen to fifteen joints. The males with one joint more to the antennæ than the females. Palpi long; the maxillary usually four-jointed, and the labial three. Ovipositor lodged in a groove on the underside of the body.

Latreille enumerates but three genera belonging to this family. Those which have the antennæ filiform, the abdomen much compressed, the radial cell of the wing long and narrow, the two brachials very distinct, and the two first cubitals small, constitute the genus *Ibalia*.

The species of the next genus (*Figites*) have the abdomen thickened and rounded above, the antennæ gradually thickened towards the apex, but one brachial cell, the radial very distant from the apex of the wing, and the second cubital wanting.

In the genus *Cynips* the abdomen is similar to the last, but the antennæ are filiform; there are three cubital cells to the wing, the first of which is large: the radial is elongated, and there is but one complete cell at the base of the wing. [GALLS.]

GALLIE'NUS, PUBLIUS LICINIUS, son of the emperor Valerianus, was made Cæsar and colleague to his father A.D. 253. He defeated in a great battle, near Milan, the Alemanni and other northern tribes which had made an irruption into North Italy, and gave evidence of his personal bravery and abilities. He was also well informed in literature, and was both an orator and a poet. When Valerianus was taken prisoner by the Persians, A.D. 260, Gallienus took the reins of government, and was acknowledged as Augustus. He appears to have given himself up to debauchery and the company of profligate persons, neglecting the interests of the empire, and taking no steps to effect the release of his father from his hard captivity, in which he died. The barbarians attacked the Empire on every side, revolts broke out in various provinces, where several commanders assumed the title of emperor, whilst Gallienus was loitering at Rome with his favourites and mistresses. Yet now and then he seemed to awaken from his torpor, at the news of the advance of the invaders, and putting himself at the head of the legions, he defeated Ingenus, who had usurped the imperial title in Illyricum. But he disgraced his victory by horrible cruelties. [BYZANTIUM.] Meantime Probus, Aurelianus, and other able commanders, were strenuously supporting the honour of the Roman arms in the East, where Odenatus, prince of Palmyra, acted as a useful ally of the Romans against the Persians. Usurpers arose in Egypt, in the Gauls, in Thrace, in almost every province of the Empire, from which circumstance this period has been styled the reign of the thirty tyrants. At last Aureolus, a man of obscure birth, some say

a Dacian shepherd originally, but a brave soldier, was proclaimed emperor by the troops in Illyricum, entered Italy, took possession of Milan, and even marched against Rome while Gallienus was absent. Gallienus returned quickly, repulsed Aureolus, and defeated him in a great battle near the Adda, after which the usurper shut himself up in Milan, where he was besieged by Gallienus, but during the siege the emperor was murdered by some conspirators, A.D. 268. He was succeeded by Claudius II. Trebellius Pollio has written a history of the reign of Gallienus. [AUGUSTA HISTORIA.] See also Zonaras, Aurelius Victor, and Eutropius.

Coin of Gallienus.

British Museum. Actual size. Copper gilt. Weight, 223 grains.

GALLI'NÆ, Gallinaceous Birds, the fifth order of the class *Aves*, according to Linnæus, who thus characterizes it: *Bill* (a reaping sickle, *Harpa colligens*) convex: the upper mandible arched over the lower; *Nostrils* overarched by a cartilaginous membrane. *Feet* formed for running, the toes rough below. *Body* sebaceous, muscular, delicate (*purum*). *Food*, grain collected on the earth and macerated in the crop (*ingluvies*). *Nest* artless and placed on the ground; eggs numerous; food pointed out to the young by their parent. Polygamous. Analogous to the order *Pecora*, in the class *Mammalia*. [RASORES.]

GALLINSECTA (Latreille), COCCIDÆ (Leach), a family of insects placed by Latreille and others at the end of the Homoptera. These insects apparently have but one joint to the tarsi, and this is furnished with a single claw. The males are destitute of rostrum, and have two wings, which when closed are laid horizontally on the body: the apex of the abdomen is furnished with two setæ. The females are apterous, and provided with a rostrum. The antennæ are generally filiform or setaceous.

The insects belonging to this family live upon trees or plants of various kinds: they are of small size, and in the larva state have the appearance of oval or round scales, which are closely attached to the plant or bark of the tree they inhabit, and exhibit no distinct external organs. At certain seasons, when about to undergo their transformation, they become fixed to the plant, and assume the pupa state within the skin of the larva. The pupa of the males have their two anterior legs directed forwards, and the remaining four backwards; whereas in the females the whole six are directed backwards. When the males have assumed the winged or imago state, they are said to issue from the posterior extremity of their cocoon.

In the spring time the body of the female becomes greatly enlarged, and approaches more or less to a spherical form. In some the skin is smooth, and in others transverse incisions or vestiges of segments are visible. It is in this state that the female receives the embraces of the male, after which she deposits her eggs, which are extremely numerous. In some the eggs are deposited by the insect beneath her own body, after which she dies, and the body hardens and forms a scale-like covering, which serves to protect the eggs until the following season, when they hatch. The females of other species cover their eggs with a white cotton-like substance, which answers the same end.

Upwards of thirty species of the family Coccidæ, or Gallinsecta, are enumerated in Mr. Stephen's Catalogue of British Insects; several of these however have undoubtedly been introduced with the plants they inhabit, and to which they are peculiar.

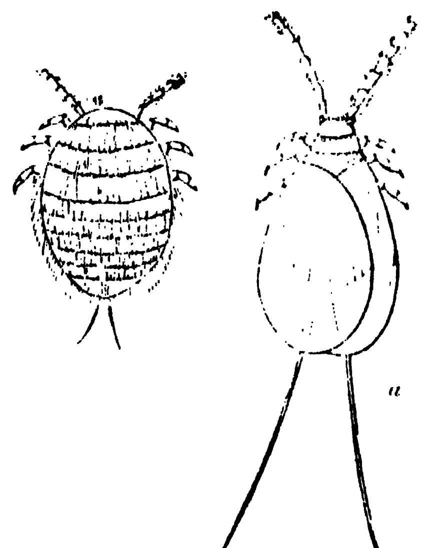
Many of the exotic Cocci have long been celebrated for the beautiful dyes they yield. The Coccus Cacti of Linnæus may be mentioned as an instance. The female of this species is of a deep brown colour, covered with a white powder, and exhibits transverse incisions on the abdomen. The male is of a deep red colour, and has white wings.

This insect, which when properly prepared yields the dye called cochineal, is a native of Mexico, and feeds upon a particular kind of Indian fig, which is cultivated for the express purpose of rearing it. [COCHINEAL.]

Coccus Ilicis, an insect found abundantly upon a small species of evergreen oak (*Quercus coccifera*), common in the south of France, and many other parts, has been employed to impart a blood red or crimson dye to cloth from the earliest ages. (*Introduction to Entomology*, by Kirby and Spence, vol. i., p. 319.)

Coccus Polonicus is another species which is used in dyeing, and imparts a red colour. It is now chiefly employed by the Turks for dyeing wool, silk, and hair, and for staining the nails of women's fingers. (Kirby and Spence, vol. i., p. 320.)

But we are not only indebted to the Coccus tribe for the dyes they yield: the substance called Lac is also procured from one of these insects (the *Coccus Lacca*). This species inhabits India, where it is found on various trees in great abundance. 'When the females of this Coccus have fixed themselves to a part of the branch of the trees on which they feed (*Ficus religiosa* and *Indica, Butea frondosa*, and *Rhamnus Jujuba*), a pellucid and glutinous substance begins to exude from the margins of the body, and in the end covers the whole insect with a cell of this substance, which when hardened by exposure to the air becomes lac. So numerous are these insects, and so closely crowded together, that they often entirely cover a branch; and the groups take different shapes, as squares, hexagons, &c., according to the space left round the insect which first began to form its cell. Under these cells the females deposit their eggs, which after a certain period are hatched, and the young ones eat their way out.' (Kirby and Spence, vol. iv., p. 142.)



Coccus Cacti, magnified.

a, the male. *b*, the female.

GALLI'NULA. [RALLIDÆ.]

GALLIOT, a strong-built flat-bottomed vessel of a peculiar construction, used as a bomb-ship to fire against forts or batteries on the coast. The largest are of the burthen of 400 or 500 tons, and above 100 feet in length. See account and plate of the same in the *Dictionnaire de Marine*, in the *Encyclopédie Méthodique*, art. 'Galiotte.' Galliot is also a kind of small galley or large felucca, used chiefly in the Mediterranean, especially by the Barbary corsairs. [GALLEY.] The Dutch, Swedes, and other northern nations have a sort of merchant-ship which they call Galliot, heavy and clumsily built, but strong of timber, rounded both fore and aft, and of the burthen of from 200 to 300 tons.

GALLI'POLI, the antient Callipolis, in the Chersonesus of Thrace, a town of European Turkey, situated at the entrance of the Hellespont, now called the Straits of Gallipoli, on the side of the Propontis. It lies nearly opposite to Lampsaki, the antient Lampsacus, on the Asiatic side of the channel, which is here about two

miles in breadth. Gallipoli occupies a considerable space, but is not peopled in proportion to its extent. It has an extensive bazaar, with domes covered with lead, and the shops are tolerably supplied. This town is interesting as being the first place in Europe where the Turks acquired dominion. Tournefort gives an account of its history, and of the legends of the Osmanlis in relation to their early conquest. The town now contains 'a mixed population of Turks, Greeks, Armenians, and Jews, somewhat exceeding 20,000, which some travellers have swelled to 60,000. Its trade consists in corn, wine, and oil. In the vicinity of the town are some fertile patches of land cultivated by Greeks, but beyond them you get into a desert.' (Macfarlane's *Constantinople in* 1828.) Excellent water-melons grow in the neighbourhood of Gallipoli. Consuls or vice-consuls of several European powers reside in this place.

GALLIPOLI. [OTRANTO, TERRA DI.]

GALLON, an old English measure of capacity. The Latin of the middle ages is *galo, galona, jalo, lagena*, &c. Dr. Bernard thinks the latter is the original. Ducange cites an old assize of David of Scotland, in which it is said the *lagena* should contain twelve pounds of water, namely, four of sea water, four of still water, and four of running water. But that various gallons were used is evident from statutes of Henry III. and later kings, in which it is enacted that ale, wine, and corn shall be measured by the same gallon, containing eight troy pounds of dry wheat from the middle of the ear. These statutes produced no effect, and distinct gallons for wine, ale and beer, and corn and dry goods, continued in use until the act of 5 Geo. IV., cap. 74, which came into operation May 1, 1825.

By statutes of 1689 and 1697, the wine gallon was declared to contain 231 cubic inches. But in 1688, by an experiment at which Flamsteed, Halley, and others (among whom was Ward, author of the 'Young Mathematicians' Guide,' who relates the circumstance) were present, it was very distinctly proved that the sealed gallon at Guildhall (which was the *usual* standard) contained only 224 cubic inches. 'However,' says Ward, 'for several reasons it was at that time thought convenient to continue the former supposed content of 231 cubic inches.' The fact was, that the Guildhall gallon was an incorrect copy of the old Exchequer standard, placed in a more accessible locality. Previously to this, Dr. Bernard had stated his full conviction, from the measurements of predecessors whom he cites, that the said gallon contained 223·549 cubic inches; the agreement of these two experiments leaves no doubt as to their accuracy. By the act of the 5th of queen Anne, the wine gallon of 231 inches was made the standard; and a gallon was accordingly constructed for the Exchequer, which the Committee of the House of Commons, in 1758, found to contain $231\frac{1}{10}$ cubic inches. The account of the experiment in 1688 was preserved, and is cited by the Committee.

The ale gallon was measured in 1700 or thereabouts, and found to contain 282 cubic inches. Ward imagines that this gallon was meant to bear the same relation to a pound avoirdupois which the wine gallon did to a pound troy; and 231 is to 282, very nearly as 5760 to 7000, the latter being the proportions of the two pounds. But if the wine gallon were only 224 cubic inches, then the ale gallon should have been $272\frac{1}{4}$; or, as we shall see, the corn gallon much more nearly coincides with the hypothesis.

The corn gallon was thought, in the middle of the last century, to contain exactly $272\frac{1}{4}$ cubic inches. Dr. Bernard, on the same authorities, states it to have been determined at 266 cubic inches; and the statute of 1697, which declares that a round corn-bushel must be 8 inches deep, and $18\frac{1}{2}$ inches wide, had in fact fixed the gallon at $268\frac{6}{10}$ cubic inches.

The imperial gallon, as settled by the act of Geo. IV., is to contain 10 pounds avoirdupois of distilled water, of which it is declared that 252·458 grains fill a cubic inch: consequently, the imperial gallon contains 277·274 cubic inches; being very nearly a mean between the old ale and (previously to 1697) corn gallon. According to the parliamentary standards, then, we have

Old wine gallon, 231 cubic inches.
Old corn gallon, 268·6 do.
New imperial gallon, 277·274 do.
Old ale gallon, 282 do.

GALLOWAY (called by the Latin writers of the middle ages Gallovidia, from the Irish who once inhabited it) is an extensive district in the south-west of Scotland, comprising the shire of Wigtown and stewartry of Kirkcudbright, together with part of the shires of Ayr and Lanark. It is bounded by the sea, the firth of Solway, and the river Nith, and is divided into Upper and Lower Galloway. It appears to have been independent until after the overthrow of the Picts, when the Scottish monarchs assumed a feudal superiority over the lords of Galloway. The lordship subsequently descended to the family of Douglas, with whom it remained till 1455, when, in consequence of the rebellion of James, earl of Douglas, the estates became forfeited to the crown. The extensive line of coast is so conveniently indented with lochs, bays, and navigable rivers, that were it not for the scarcity of coal it would be one of the most eligible situations in the island, in point of natural advantages, for a trading or manufacturing district. At the south-western extremity is the well-known promontory called the Mull of Galloway, where there are some excellent quarries of whinstone, freestone, and slate. The general appearance of the district is rugged and mountainous, producing little else than pasturage for sheep and cattle, which are bred in large numbers, principally for the supply of the English market. The small horses known by the name of Galloways are also bred here. [WIGTOWN; KIRKCUDBRIGHT; &c.] (Camden's *Britannia; Statistical Acct. of Scotland; Beauties of Scotland;* &c.)

GALLS are the result of a morbid action excited in the leaf-buds of several species of the genus Quercus, or oak, occasioned by an insect, Cynips Quercus, depositing its ova in the bud. Such buds, instead of elongating and becoming branches, undergo a peculiar transformation, and enlarge into a globular figure, so as to constitute a fit nidus for the future larva.

The galls of commerce are chiefly those which occur on the Quercus infectoria (Ollivier). They vary in size, from that of a pea to that of a nutmeg. The surface has irregular elevations or lines, with the interspaces generally smooth. The colour is white or yellow in one variety; green, grey, or black in another. The white variety, which is the largest, often has a hole in the substance of the shell, by which the larva has escaped. This kind is the least powerful and least esteemed. The best galls come from Aleppo and Smyrna, but are often mixed with those from Syria and Cyprus. In 100 parts of Aleppo galls Sir H. Davy found gallic acid, 6·2; tannin, 26; gum and insoluble tannin, 2·4; lime and other salts, 2·4; woody fibre, 63. Braconnot also found ellagic acid. Galls are devoid of smell, but have a disagreeably bitter taste, with a powerfully astringent action. The whole of their soluble matter is yielded to forty times their weight of boiling water; æther dissolves about half their weight, alcohol considerably more.

The infusion possesses all the valuable properties of the gall, as does an alcoholic tincture; but decoction is an objectionable preparation. For internal use the infusion is preferable to the powder, which, like all substances containing much woody fibre, irritates the stomach. Galls may be employed in powder to form an ointment, which with opium and camphor is of great service in painful hæmorrhoids. As a tonic in intermittent fever, and as an astringent in hæmorrhagic or other discharges, galls are occasionally employed. But the most extensive use is made of them in the arts, and as a chemical test.

GALLUS (Zoology). [PHASIANIDÆ; POULTRY.]

GALUPPI, BALDASSARE, a composer of great reputation in his day, very commonly known by the name of Buranello, from having been born in the island of Burano, near Venice. He was a disciple of the famous Lotti, and his first opera was produced at Venice in 1722. In the middle of the last century Galuppi's works were highly esteemed, and some of his compositions would now, if properly arranged, find abundant admirers among the lovers of good dramatic music.

GALVA'NI, ALOYSIUS (Lewis), was descended from a respectable family of Bologna, which had produced several distinguished men of letters. He was born in that town in 1737, and in consequence of a religious turn of mind which he strongly displayed during his childhood, was at first designed for holy orders and to take the monastic vows. He afterwards changed his intentions while studying at the university of Bologna, and married the daughter of his tutor Galeazzi, who was a professor at that university, and with whom he had for some time lived on terms of close intimacy. His degree of M.D. was con-

ferred in 1762, and his fame had so far increased that he received the appointment of Lecturer on Medicine at the Institute of his native town. In the 'Memoirs' of this body we find contributions on various medical subjects by Galvani. He also published separately 'Observations on the Urinary Organs,' and 'On the Organs of Hearing in Birds;' but an accidental circumstance, of which he availed himself with acuteness and much judgment, introduced him to a novel subject, the announcement of which at that time excited deep attention throughout Europe, and gave birth to a new and fruitful branch of Physics, which yet retains in all countries the name of its first observer.

During his temporary absence from his house, his wife, who was about to prepare some soup from frogs, having taken off their skins, laid them on a table in the studio near the conductor of an electrical machine which had been recently charged. She was much surprised, upon touching them with the scalpel (which must have received a spark from the machine), to observe the muscles of the frogs strongly convulsed: she acquainted him with the facts upon his return; Galvani repeated the experiment, and found that it was necessary to pass a spark or communicate electricity through the metallic substance with which the frogs were touched. After having varied the experiment in several ways, he was led to conclude that there existed an Animal Electricity both in nerves and muscles, and some future experiments appearing favourable to that erroneous inference, he seems to have clung to that opinion during the remainder of his life, notwithstanding the experiments of Volta and others, which showed at least that the moisture on the surface of the frog acted as a conductor.

The following circumstance was that on which Galvani most relied for the accuracy of his opinion. Having seen the effects of the direct electricity of the machine on the muscles of frogs, and that by exposing only the spine, legs, and connecting nerves to the electrical action a very small charge was sufficient to produce the convulsive motions: he imagined that the atmospheric electricity, though of feeble tension, might be sufficient to produce like results. He therefore suspended some frogs thus prepared by metallic hooks to iron railings, when he observed that the convulsed motions depended on the position of the frog relative to the metals. The same phenomenon led Volta to an opposite conclusion, and a war of opinion for some time divided philosophers; into this dispute it will not be necessary now to enter. Ultimately Volta triumphed over Galvani, but failed to convince him.

The work in which Galvani developed his views relative to this new class of phenomena was published in 1791, under the title 'Aloysii Galvani de viribus Electricitatis in Motu Musculari Commentarius,' in which he infers that the bodies of animals possess a peculiar kind of electricity, by which motion is communicated by nerve to muscle, and in these experiments he regarded the metals acting only as conductors between these substances, which he thought accounted for the observed contractions of the muscle, in the same manner that the dissimilar electricities on the interior and exterior surfaces of a Leyden jar reunite with explosion through a metallic conductor. If the reader is desirous to make an experiment of this kind, let him separate the head and upper parts of the body of a frog, remove the skin from the legs, clear out the abdomen, separate the spine below the origin of the sciatic nerves, that they alone may form the connection with the legs; then envelop the spine and nerves with tinfoil, and placing the legs on silver, complete the circuit by making the two metals touch: the convulsive motions will be instantly produced.

Philosophers in other countries hastened to repeat and vary these experiments. Fowler found that when the circuit was completed by the eye, the contact of the metals produced the sensation of a flash of light; and Robinson remarked the acid taste when the tongue was used between the metals, to which he also attributed the peculiar taste of porter when drank from a pewter vessel. It may be added that Sulzer, as early as 1767, described the influence upon taste caused by the contact of different metals with each other and with the tongue; results of this kind were pursued with more eagerness than nature seemed willing to gratify, and the influence of Galvanism on the senses of smelling and hearing, which Cavallo thought he had observed, have not been verified, or rather, have been disproved.

The interesting researches of Galvani having acquired such extensive notoriety (See *Phil. Trans.* 1793), introduced him to the pleasures and the troubles of an extensive correspondence. In 1797 Galvani made a voyage along the shores of the Adriatic for the purpose of confirming his notions on animal electricity by experiments on the Gymnotus, from which he concluded that the brain contributed to produce the observed effects. His wife, who had proved herself a sensible and an affectionate woman, died soon after his return, a loss which he seems to have felt very severely. His afflictions were increased during the French occupation of Italy; he was expelled from the offices which he held, because he refused the prescribed oaths, when Bologna formed a part of the Cisalpine Republic. His pecuniary circumstances at this time, as well as his health, were in a very low state, and shortly after his restoration to his former offices he died, in 1798.

In two years after the death of Galvani, his nephew Aldini produced convulsive motions of the kind above noticed in the body of a convict who was hanged at Newgate.

GALVANISM. This department of electricity takes its name from Galvani; but its infant progress was due in a much greater degree to his contemporary Volta, by whom piles were first constructed for increasing the intensity of the electricity produced by a single pair of plates. The production of electricity in this case arises from the action of the acid in the cell between two plates of dissimilar metals, that which is the more oxidable giving out positive electricity, as explained under ELECTRO-DYNAMICS. The forms in which the piles have been constructed are various, and the number of plates is adapted either to the quantity or intensity of electricity which may be desired. When quantity with a feeble tension is requisite, a single pair of plates, such as zinc and copper, with extensive surfaces, separated by very dilute acid, will answer; but with a system of pairs of plates, where the copper of the first pair *conducts* its electricity to the zinc of the second, and so on, the quantity and intensity are increased with the number of the plates. In some constructions, as Ritter's dry piles, the plates are simply laid on each other, those of each pair being separated by moistened paper; in others the plates lie parallel in a trough of baked wood, by which means the cells are easily filled and emptied. In the *couronne des tasses* of Volta the plates are placed circularly or in a bowl shape; while in Hare's Calorimotor there is merely one zinc plate and one copper twisted into a great number of coils, which form increases the intensity, as may be seen from the article ELECTRO-DYNAMICS. This construction has been much employed by Pepys, Faraday, and others.

The electricity thus produced is of the same nature as that given by the common machine; the only difference being that the mode of producing galvanism is continuous, that is, when in any way discharged it is immediately reproduced by the oxidation of the zinc; and hence many galvanic phenomena have been successfully imitated by a series of sparks of ordinary electricity. When the positive and negative wires are made strictly to communicate by metallic conductors, the combination of the opposite electricities causes all phenomena analogous to those produced by the ordinary machine to cease, but gives birth to the electro-dynamic and electro-magnetic phenomena. [ELECTRO-MAGNETISM.] But when the wires from the opposite poles of the battery are only brought sufficiently near that the current may pass through an interposed substance, or when the circuit is completed by imperfect conductors, the physical changes which the interposed substances undergo constitute the phenomena of galvanism. It may be observed that the relative conductibility of substances for Voltaic electricity is nearly the same as for common, but the alterations produced by the former in the temperature and internal nature of the substances through which the current is admitted interfere in some degree with that order of conductibility.

The deflagration of metals is effected by beating them into thin leaves, which are then interposed between the extremities of the positive and negative wires of the battery, brought within a quarter of an inch of each other: they will then burn with a beautiful light, but which is of different colours in different metals. Thus—zinc gives a white light with a reddish border; copper, a bluish white light, and throws out red sparks; lead, a purple light; gold leaf, a beautiful white light tinged with blue.

But if the interposed substances, instead of being laminæ, be of small irregular forms, or wire-shaped, their temperature rises rapidly as the electric current permeates them. Steel

burns, iron wire dissolves in globules, while charcoal produces a light of such dazzling brilliancy as to fatigue the eye, a property which has been happily seized by employing it in the solar microscope; yet this heat and light are independent of the ambient medium, no oxygen is consumed, and the attenuation of the air rather adds to than diminishes the light. As for the apparent diminution of this intense light when the charcoal is immersed in water, it is attributable to the imperfect conductibility of the latter medium: a thermometer placed in water, in which the wires are immersed, will rise even to the boiling point. Mr. Children has given a list of the order of facility in which substances thus acquire a red heat, and has succeeded in fusing the oxides of molybdenum, tungsten, uranium, &c., but found ruby, sapphire, silex, quartz, &c., more intractable. It is obvious that, in the estimation of such an order, we must take an account of the mass heated, and of the extent of its surface which is liable to cool by contact, radiation, or both; and lastly, of the loss of conductibility due to the increase of temperature of the substance interposed. Æther, alcohol, &c., may be inflamed, and gunpowder exploded, by making the discharge through charcoal points.

Sir Humphry Davy avoided the increase of temperature in the wires through which the current was discharged by taking them of a length sufficient to discharge the number of pairs of plates employed in the pile, and thus found that the length of wire in this case is inversely proportional to the number of double plates. The diminution of conductibility due to increase of temperature he exhibited by a platinum wire made red-hot by the galvanic current; for when he raised one part of it to a white heat by means of a blowpipe, the heat in the other parts of the wire became immediately reduced. The order of heating in metals, beginning from that most susceptible, which he has given, is as follows: —iron, palladium, platinum, tin, zinc, gold, copper, silver.

The decomposition of water by the battery is effected by bringing the points of the positive and negative wires very near each other under water, inverted glasses being placed over them to collect the gases which are evolved. If the wires be not oxidable, then oxygen gas will be formed at the extremity of the positive wire, and hydrogen at the negative, in the same proportions in which they constitute that liquid; but if oxidable, then the positive wire will be covered with an oxide, while the negative wire still produces hydrogen gas. In general oxygen and chlorine are found at the positive pole, and the other gases at the negative; but we are not to suppose that oxygen only is disengaged by one wire, and hydrogen only by the other; for the particles of water in contact with the ends of either wire are strictly decomposed into their constituent gases, but the oxygen formed at the negative wire is transferred to the positive, and the hydrogen at the positive is transferred to the negative.

The chemical analysts were at first somewhat puzzled at finding foreign products, when producing decomposition by galvanism; soda, which was sometimes found, was due to the decomposition of small portions of the glass in which the experiments were made, and muriatic gas to vegetable substances employed occasionally, as wet cotton-thread, when the liquid was contained in separate vessels having only this mutual communication.

When neutral salts were held in solution and exposed in the same manner to the galvanic action, their alkaline bases were found at the negative wire, and the acid at the positive: thus zeolite was decomposed into soda and lime; common salt into solution of soda and sulphuric acid; while the metallic solutions gave their crystals and oxides to the positive pole, and transferred the acids to the negative. Davy made the remarkable discovery that this transfer took place without any combination being effected with the parts of the medium traversed, even when the latter had a great affinity for the elements which passed through it. He arranged three cups, in the first of which was a solution of litmus (a well-known chemical test), in the second a similar solution, and in the third sulphate of soda. The positive wire was immersed in the first cup, the negative in the third; and the intermediate was connected with the two extreme cups by a moistened thread, so as to complete the circuit: the result was, that the solution of litmus in the positive cup became red, indicating the transfer of the acid from the third cup, while the similar solution in the intermediate cup underwent no change, clearly showing that the acid in its transfer did not combine with the solution through which it passed. Similarly, upon reversing the poles, a green was produced in the first cup, while the middle still remained unaffected. But he soon recognised that there was an exception to this, namely, when the transmitted substance and the medium combine so as to form an insoluble compound; for when it has thus acquired a greater specific gravity than the medium, it is necessarily drawn out of the line of transference; and if by mechanical means it should be preserved in it, the transfer will go on as before.

It may be observed generally, with respect to chemical decompositions effected by galvanism, that it is quantity rather than intensity which is requisite, and that the metals, alkalies, and earthy bases are transferred to the negative pole; the acids, oxides, and chlorides to the positive. By the successive labours of Davy, Wollaston, Brande, Gay-Lussac, Berzelius, &c., different substances which had before been supposed simple, as soda, potash, lime, barytes, strontytes, magnesia, zircon, &c., were analyzed by this powerful instrument; and though silex, alumina, &c., offered great resistance to its application, and the metallic bases were with difficulty restrained from again combining with oxygen, still in the majority of cases the analysis has been successful. The same method was applied by Brande to fluids containing albumen, when albumen and alkali were found at the negative pole, albumen and acid at the positive; he also found that though it remained fluid with a weak battery, when a stronger one was employed it was separated in a coagulated form.

Experiments of the same nature have been recently made by Mr. Golding Bird, whose results do not agree with those obtained by Brande. He used for his battery the Voltaic form, a 'Couronne de Tasse,' of thirty small plates, excited only by a weak solution of salt, and first operated on liquid albumen in a state of non-combination. Putting serum of blood into a glass vessel, and having introduced the wires of the battery, a cloudy deposition took place near the positive wire without adhering to it. The experiment being next made with two vessels connected by moistened cotton, coagulation took place in the positive vessel, while none occurred in the negative; after a time the contents of the former had an acid taste, and of the latter a caustic alkaline flavour: when all in the positive vessel was coagulated by the galvanic action, he found there hydrochloric acid mixed with chlorine, and the alkali in the negative vessel. He has given also an explanation of the causes of the difference in Brande's results.

An interesting class of experiments are due to Mr. Crosse on the employment of electricity, in a state of high tension, to form mineral and other substances. There is a cavern near Broomfield, of which the vault is covered with arragonite and carbonate of lime and fine crystals. The water which drips from this vault holds in solution ten grains of carbonate of lime and a little sulphate of the same to each pint. A glass filled with this water was submitted to the action of a battery consisting of 200 pairs of plates, and at the expiration of ten days the negative pole was found to have formed rhomboidal crystals of carbonate of lime, accompanied by some gas-bubbles, and in less than a month after the wire was covered with regular and irregular crystals, whence it follows that the bi-carbonate was decomposed into carbonate and carbonic acid gas. He also let the water drop on a piece of brick subjected to a current from 100 five-inch plates, the brick being supported by a funnel which conducted the water into a vessel below: after four or five months the brick near the negative pole of the battery was covered with carbonate of lime, while near the positive pole were disposed prismatic crystals of arragonite: and the same experiment being repeated with fluosilicic acid, regular hexahedral pyramids similar in all respects to quartz were obtained: those which were left in a dry place acquired sufficient hardness to scratch glass; the others had not that power, and gradually lost their transparency. In his varied experiments of this nature he has succeeded in forming, by means of the galvanic battery, the following minerals:—carbonate of lime; arragonite; quartz; protoxide of copper; arseniate of copper, and its blue and green carbonates; phosphate of copper; carbonate of lead; chalcedony, &c., upon which Becquerel remarks, in the last-published volume of his 'Experimental Electricity,' 'Nearly all these substances we have obtained these dozen years with the *simple* electro-chemical apparatus.'

Experiments on the increase of the chemical power of the galvanic apparatus, compared with the increase of the number of plates, have been made by Davy, Gay-Lussac, and Thénard; but they disagree. We shall therefore now pass on to a brief notice of the physiological effects produced by galvanism, from which we must exclude any account of the animalculæ observed by Mr. Crosse in the solutions employed in his recent experiments, pending the further progress of those highly interesting researches, and in the absence of any similar result in the experiments which Mr. Faraday has made with the same object.

In the life of Galvani there is an account of the convulsive motions to which denuded frogs are subject when the nerve and muscle form part of the galvanic circuit. In order that an individual may receive a shock from a battery, it is advisable to moisten the hand, because the dry cuticle is a bad conductor of electricity: then, on touching one of the wires of the battery with a metallic rod, the shock will be received and felt in the wrists, arms, or shoulders, according to the intensity of the current; or a continued sensation, resembling the piercing of a very fine needle, will be perceived by dipping the finger in a dish containing a little water in which the wires of the battery are inserted in the same line with the finger. In both cases, if the nerves are denuded by a cut, the sensation is painful, and the pain will remain some time before it subsides. In some experiments of this kind Humboldt brought on an inflammation by applying the current to a cut. Volta has asserted that the negative wire communicates the greater pain.

A flash of light is perceived by covering the bulb of the eye with tinfoil and forming a metallic communication thence with the mouth, for instance, with a silver spoon; also Berzelius found an acid taste on dipping the tongue into a zinc vessel containing water, which was placed on a silver stand, by touching the silver with his hand so as to complete the circuit. When the negative current is communicated to the taste, it is caustic and alkaline.

When the battery is applied to a nerve of a person recently dead, and the circuit is completed, several violent motions ensue, dependent on the relative position of the nerve and muscle: thus, when the wire communicates with the phrenic nerve, the muscles of respiration are set in motion; when from the ulnar nerve to the spinal marrow is included in the circuit, the fingers are set in quick motion, and so on. Fishes are still more susceptible of this electric action than animals, and strong convulsive motions will be exhibited by a live flounder placed on a zinc dish and having a piece of copper or silver on its back, as soon as the two metals come in contact: similar effects take place with leeches, worms, and amphibious animals.

It was thought by Volta that the involuntary muscles, such as the heart, could not be thus excited, but experiment has decided against him.

When the secretion was suspended by cutting the eighth pair of nerves, Dr. Philip and several French anatomists have restored it by establishing a galvanic current through the divided part of the nerves next the stomach.

Intermittent currents have been employed in the experiments of Masson, Peltier, and Delarive. To effect this, M. Masson used a toothed wheel rotating by a cord round it; its axis, supporter, and itself being all metallic: a communication is formed between this wheel and a battery in the form of a helix: the object of the teeth of the wheel is occasionally to suspend the action of the current by making the connecting rod of too great a length; hence, when the wheel is made to revolve, the galvanic current acts and is suspended alternately. By a series of intermitted discharges produced in this manner, M. Masson had the cruel pleasure of killing a cat.

P. Santi Linari drew the electric spark from the gymnotus in the following manner:—he took a glass tube of the shape of a capital U, which he partly filled with mercury; at each end was fixed an iron wire through a wooden button, and which reached very near the mercury. The apparatus being fixed with mastic on varnished wood, the end of the wires were made to touch short platina wires terminated by laminæ of the same metal, intended to make a good communication with the different parts of the electrical fish. When the circuit was formed, a spark visible even in the daylight appeared at the place where the conductors were interrupted. This experiment he has repeated in different forms. (*Biblioth. Univ. de Génève.*)

M. Delarive has lately noticed a remarkable difference of effects in the action of Voltaic and of magneto-electric currents. When the wires of the latter were used for decompositions, but in the form of thin leaves or laminæ, there was but little disengagement of gas, and the more the lamina was plunged, the less was the gas evolved, which was not the case in the common form of the wire: this does not occur in Voltaic electricity; the same experimentalist has sought the quantity of electricity necessary to decompose a given quantity of water, and his result is that the product of the time multiplied by the intensity of the current is constant.

(*Phil. Trans.* 1815, 1834, &c.; Thomson's *Annals*, vi.; Wilkinson's *Galvanism*; Nicholson's *Journal*; *Edinburgh Med. Journal*; *Annales de Chimie*; *Journal de Physique*, 64; Puffendorf, *Annalen.*; Becquerel, *Traité Experimental*; Pouillet, *Physique*; *Reports of the British Association*, &c.)

GALVANISM, in its action on the human system, resembles electricity, yet it is distinguished by certain peculiarities. In its application it can be rendered more continuous and uniform, and may, like electricity, be administered either in shocks, or in a regular flow of galvanic influence through the body. It possesses more power over the chemical actions of the body than electricity, and promotes more completely those processes of decomposition and recomposition which take place in the living frame, as well as the functions of organic life, than common electricity. But the chief distinction consists in the difference of action of the two poles. Each pole excites peculiar phenomena in the organs to which it is applied. This difference is less perceptible when mere shocks are administered, than when a continuous stream of galvanic influence is transmitted from one point to another of the body. The positive pole more particularly influences the muscular and vascular system, while the negative pole more especially affects the nervous system. At the positive pole there is felt the shock, strong movements, a feeling of concentration and contraction, increased warmth and mobility of the part, with gradual diminution of the secretion and sensibility. At the negative pole the pain and sensibility are stronger and more acute, the organ expands, is more irritable, while the muscular action and mobility are lessened. The difference of their action on the secreting powers is best seen by applying the respective poles to a surface which has been recently deprived of its cuticle, such as where a blister has been. The positive pole changes the serous secretion into that of lymph, which at last becomes thready; the part dries and is inflamed. The negative pole causes an abundant secretion of a dark coloured, highly acrid fluid, which excoriates the skin over which it flows: the part also experiences an enduring irritation. Atonic swellings are rendered harder, should they not become inflamed by the positive pole, while frequently by the negative pole they are dispersed and resolved. Notwithstanding the possession of such powerful properties, galvanism has not produced so valuable results in medicine as might have been anticipated. This comparative failure is no doubt to be attributed to errors in the mode of applying it. As the diseases in which it has been recommended are those already enumerated under electricity [ELECTRICITY, MEDICAL USES OF], it is not necessary to repeat them here. It may be proper however to remark, that it was urgently recommended during the prevalence of the Asiatic cholera, but the results were not satisfactory. Like many other powerful agents, it was not used till a very late stage in the complaint, when recovery was almost impossible. It is also to be doubted whether galvanism be at all applicable to cholera, since it appears that the continued application of it causes death, by inducing inflammation of the lungs, in cases of animals where the eighth pair of nerves have been divided, more speedily than where the same nerves have been divided in animals to which the galvanic power was not applied as a substitute for the nervous. Inflammation is the invariable consequence of the application of the positive pole; while the negative pole would cause a flow of acrid secretion which could not benefit the patient. The identity of electricity, whether common or galvanic, with the nervous power, is much to be questioned. (See controversy between Dr. W. Philip, Dr. Williams, and others, in *Medical Gazette*, vol. xvii.)

GALVANO'METER, or MULTIPLIER, is an instrument constructed for the purpose of detecting the presence of feeble electro-chemical currents. The nerves and muscles

of newly killed frogs were at first used; but the discovery of electro-magnetism has furnished a more delicate and measurable criterion: the instrument founded on this principle has been successively improved in the hands of Schweigger, Cumming, Nobili, and Melloni, to a most remarkable degree of delicacy.

The principle of the construction depends on the property possessed by electrical currents of acting on magnetised needles; for if the conducting wire be placed on the magnetic meridian above or below the needle, the latter will suffer a deviation to the right or left according to the direction of the current.

The action of terrestrial magnetism tending to restore the needle, after its derangement by the current, to its original position, is almost entirely corrected by employing two similar needles supported parallel to each other by a light piece of straw or other substance, and placed with the poles of one in an inverse position to those of the other. This apparatus being suspended by a fine silk thread, is placed in a wooden box of the form of a parallelopiped of small width, round which the conducting wire is passed in a great number of coils, which are kept from communicating by being doubly wrapped in silk or other non-conducting substance; the number of coils in some such instruments has been more than 500, by which the effect produced on the needle by a single current is multiplied twice as many times, since the opposite sides of each coil double the action of either side; and the terrestrial polarity of the needle being counteracted in the manner above mentioned, this simple instrument acquires a very great sensibility.

Modifications of the above construction have been made by Person, Peltier, and others, and a moveable index has been attached, particularly when weak thermo-electric currents are to be examined. Four needles have been used by some instead of two, but the principle of the construction in all cases is the same as that which has been described.

On the construction of electroscopes and galvanometers, the reader may consult *Annales de Physique*, t. xvi., p. 91, by Bohnenberger; t. xxii., p. 358, by Oersted; t. xxxiii., p. 62, by Colladon; t. xxxviii., p. 225, by Nobili; t. xlviii., p. 113, by Nobili and Melloni. Also *Biblioth. Univ.*, t. xxxviii., p. 79, by Nobili; *Phil. Trans.* 1823, by Pepys; also *Annals of Philosophy*, 1824, &c.

GALWAY, a maritime county of the province of Connaught, in Ireland; bounded on the north by the county of Mayo; on the north-east by the county of Roscommon, from which it is separated for the most part by the river Suck; on the east by parts of the counties of Westmeath, King's County and Tipperary, from which it it separated by the river Shannon; on the south by the county of Clare, and on the west by the Atlantic Ocean. It extends from 52° 57′ to 53° 42′ N. lat., and from 7° 53′ to 10° 15′ W. long., being about 164 English miles in length from east to west, and 52 in breadth from north to south. The extent of coast, which is very irregular, has been estimated at 400 miles; and the Shannon and Suck, both navigable rivers, nearly surround the rest of the county. The area, according to the Ordnance Survey, consists of—cultivated land, 955,713 acres; unprofitable bog and mountain, 476,957 acres; water, 77,922 acres; or 2360 statute square miles. The population, exclusively of the county of the town of Galway, was, in 1831, 381,564.

Physical Character, Rivers, Coast, &c.—With the exception of a spur of the Slieve Boughta mountains, running from the Clare boundary on the south-east towards Loughrea, and a similar extension of the Burrin range [CLARE] on the south-west of the same district, the whole of that part of Galway which lies east of Loch Corrib, being nearly of the same extent with the county of Tipperary, is comparatively flat, and although to a great extent encumbered with bog, is pretty generally improved and productive. A low table-land running north and south separates this part of Galway into two nearly equal districts, the waters of one of which run eastward into the Suck and Shannon, and those of the other westward into the head of Galway Bay and Loch Corrib. The district of the Suck is most encumbered with bogs; nevertheless it contains much well-improved land, particularly in the neighbourhood of Ahascragh and Ballinasloe. The district bordering on the Shannon also contains a large portion of bog on that side next the river, but has a good share of cultivation and improvement towards the interior. The district extending eastward from the head of Galway Bay is the richest part of the county. The country east of Loch Corrib is more diversified with hill and dale, and is generally in a good state of improvement. The centre of this eastern district of Galway is a bare flat tract, not equal in fertility to any of the other portions.

The whole district west of Lochs Corrib and Mask is known by the general name of Connamara, and has latterly attracted much attention by its capabilities of improvement, as well as by the uncommon wildness and beauty of its scenery. The bay of Galway bounds it on the south, the Atlantic on the west, and a deep inlet of the sea, called the Killery harbour, separates it on the north from the mountainous district of Murrick, in Mayo. From the head of Loch Corrib on the east to Achris Head on the west, this district extends 40 English miles; and from the head of Killery harbour on the north, to the shore of the bay of Galway on the south, 30 miles. The most prominent object is a group of conical mountains called the Twelve Pins, (probably Bins, synonymous with the Scotch Ben), of Bunnabola, rising abruptly from a table-land of moderate elevation which stretches south and west from their bases to the sea, and forms the chief habitable portion of the district. Round their bases are numerous lakes, of which the chief are Loch Ina, under the eastern front of the group; the upper and lower lakes of Ballinahinch skirting them on the south, and Lochs Kylemore and Foe lying between their northern declivities and the opposite range, which rises along the southern shore of the Killery. The average height of these mountains is about 2000 feet; some rise to 2400 feet, and as the table-land from which they rise is only of moderate elevation, their appearance is very striking. Northward and eastward from the Twelve Pins a range of equal altitude, but not of so picturesque a character, covers an area of about 200 square miles, between the head of Killery harbour and the western shore of Loch Mask. About midway between these waters lies the lake of Loughnascoy, north of which, to the boundary of Mayo, the country is entirely uninhabited. The chief elevations of this group, on the west, are Shanafola, at the head of Loch Corrib; Ben Leva, the declivities of which form the isthmus between Lochs Corrib and Mask; and the range of Maam Trasna overhanging the western shore of the latter lake. On the north the range of Furmnamore extends along the Mayo boundary, and on the west and south Maam Turk and Mameam rise over Loch Ina opposite to the eastern part of the group of Bennabola. Although this entire tract of country is generally known by the name of Connamara, it is properly divided into three districts: the portion last described, between the head of the Killery and Loch Corrib, being termed Joyce Country; that lying south of the Pins and range of Shanafola and Mameam being Iar-Connaught, or Western Connaught; and the remainder, extending westward from the Pins to the Atlantic, constituting Connamara Proper. The islands off the coast of Galway are very numerous; the chief are the three south islands of Arran, lying about midway between the coasts of Iar-Connaught and Clare, in the opening of the bay of Galway, and the islands of Innisturk, Innisboffin, and Innishark, extending, in like manner, across the offing of Killery harbour, between the coasts of Connamara and Murrisk.

On the southern side of the bay of Galway the coast is not favourable for the construction of harbours. From Burrinquay, in the county of Clare, to Kinvarra, at the head of the bay, there is no place of shelter for craft except at Killaney in Arran, and Durus on the mainland, opposite the town of Galway. The creeks of Ballynacourty and Rhenville are good harbours for vessels of a small class at the head of the bay, and the harbour of Galway has lately been much improved. Westward however from Galway, and round the entire coast of Iar-Connaught and Connamara to the boundary of Mayo, there is a succession of harbours for vessels of the largest class, unequalled perhaps on any similar extent of coast in Europe. The first of these noble roadsteads next Galway is Costello bay, at the mouth of the celebrated fishing stream the Costello, where a small pier was erected in 1822 for the accommodation of fishing-boats and merchant vessels. This harbour admits large ships, and is defended by a martello tower. Casheen bay, Greatman's bay, and Kilkerran bay occur immediately west from the Costello, being separated from one another by narrow peninsulas. The last-mentioned bay contains one hundred miles of shore, and is capable of receiving the largest vessels. A pier, five hundred feet in length, with a return of one hundred, was constructed

here in 1822; but as there is no road of any kind to the shore, it has been of comparatively little service. An extensive peninsula (ten miles by seven), interspersed with lakes, but destitute of roads of any kind, separates Kilkerran bay from the bay of Birterbuy, which runs inland about five miles, being only half a mile wide at the entrance, and from two to three miles wide within; it has deep water and fine ground, and might be easily fortified, so as to form a most desirable station for ships of war. On the western side of the entrance to Birterbuy bay is the opening of Roundstone harbour, a safe and capacious inlet, with clean good ground, and two to five fathoms' water. Roundstone harbour has been much spoken of as the terminus of a western Irish railway. At the head of the harbour, where the waters of the lakes of Ballinahinch and Loch Ina discharge themselves, is an excellent salmon fishery. A considerable village has sprung up within the last ten years at Roundstone, and as a road runs hither from the main line of communication between Galway and Clifden, there is a prospect of it becoming a place of some trade, especially as it is the nearest point for the shipment of the fine green marble of Ballinahinch. From Birterbuy the coast stretches, with occasional anchorages, to Slyne Head, the most western point of Galway; off Slyne Head lie a number of islands with navigable sounds between them, which remained unnoticed in the maps till Mr. Nimmo's coast survey, made for the late Commissioners of Irish fisheries: had the existence of these sounds been known, it is believed that many shipwrecks might have been prevented. Between Slyne Head and Achris Head occur the bays of Mannin and Ardbear, or Clifden; the former possessing one good anchorage, but exposed, and the latter an excellent harbour with safe anchorage in six to eight fathoms' water. At the head of this harbour a considerable town has grown up since 1822, at which time it consisted only of one slated house and a few thatched cabins. The commencement of a pier here by the proprietor, Mr. D'Arcy, assisted by Government in 1821, seems to have been the first step towards raising the place above the wilds which still surround it. So successful have the efforts of the proprietor been, that Clifden, in 1826, contained about one hundred good houses, roofed with Bangor slates, and about thirty country shops, the sales of which were estimated to contribute upwards of 3000*l*. per annum in direct taxes to the Government; and the consumption of taxable commodities is now stated to have increased to double the amount. In 1821 the population was 290; in 1831 it was 1257.

There is now a regular market in Clifden for corn, where, ten years ago, all the corn required was brought in barrels from Galway. A brewery, distillery, and milling concerns contribute principally to the demand; but there is also a regular export of corn and butter to Liverpool. As early as 1825 there were seven cargoes imported direct into Clifden for the use of the country; and there is now a regular import from America. North of Clifden harbour is Cleggan, an excellent roadstead, with a pier built in 1822, to which a branch of the new coast-road has been extended. Between Cleggan bay and the point of Renvyle, which forms the southern boundary of the entrance to the Killeries, is the harbour of Ballynakill, well sheltered by the island of Truchelaum, and capable of receiving vessels of the largest class. Rounding the point of Renvyle there is an open bay, from the head of which two inlets run eastward between steep mountains. These are the Great and Little Killeries; the latter an arm of the sea, about twelve miles in length, by a quarter to three-quarters of a mile in width, having, for a great part of its length, ten to twelve fathoms of water and clean ground. An island at the mouth completely protects it from the sea, but from being overhung on each side by steep and lofty mountains it is exposed to squalls, and not safe for sailing boats. The scenery of the Great Killery is much admired, and considered to approach nearest to the Norwegian *fiords* of any in these islands. On the whole there is no part of this district more than four miles from existing means of navigation. The harbours fit for vessels of any burthen are upwards of twenty in number; it contains twenty-five navigable lakes of a mile or more in length, and hundreds of smaller size. Loch Corrib and Loch Mask alone have upwards of seventy miles of navigable coast; and all these waters abound with fish. The sea-shore affords a constant supply of red and black seaweed, which can be used either as manure, or in the manufacture of kelp, of which latter article upwards of fifteen thousand pounds' worth has been manufactured in one season. Banks of calcareous sand and beds of limestone are of frequent occurrence, and there is an inexhaustible supply of peat fuel and of water-power. Yet, notwithstanding these capabilities, if the neighbourhoods of Clifden and Roundstone be excepted, the population still continues poor and thinly scattered along the coast, leaving the interior almost wholly waste. The population of this district is at present under 65,000, and the entire rental about 50,000*l*. per annum; although it is estimated to contain 350,000 Irish, or 615,000 English acres.

The rivers of Galway, being either feeders of the Suck and Shannon, or descending by short courses from the western district to the sea, are in general small. The river of Clare-Galway, which rises near Dunmore, in the north-east of the county, and passes near Tuam, has a course, from its source to its termination in Loch Corrib, of about 50 English miles. South of Tuam it expands into a periodical lake or turlogh: the waters generally rise in September or October, and do not subside until May, after which a coarse grass springs up, which is generally grazed as a common by the tenants of the adjoining land. Similar turloghs mark the surface of the country throughout the entire district bordering on the county of Clare; a phenomenon which is probably owing to the porous nature of the limestone rock which forms the substratum, which, being saturated with the autumnal rains, ceases during the winter to absorb the surface waters. Here, as elsewhere, on the verge of the great limestone tract which extends throughout the central district of Ireland, it is frequently perforated by subterranean cavities, which occasion the disappearance of numerous streams, and in some instances absorb considerable rivers. Thus, the river of Shruel, on the northern border of this part of the county, dips underground near Moycastle, and emerges before it terminates in Loch Corrib. The entire waters of Loch Mask also pass more than two miles by subterraneous channels under the isthmus of Cong into Loch Corrib. A considerable stream, which rises near Loughrea, after a south-western course of ten miles, during which it dips underground for half a mile, disappears in a turlogh about five miles from Gort; and two other streams in the more immediate neighbourhood of Gort sink and emerge frequently, and finally disappear without any visible outlet. The lakes of Loughrea and Gort are fine sheets of water; the latter has well-wooded banks and a very picturesque vicinity.

An extension of the Grand Canal connects Ballinasloe with the line to Dublin at Shannon Harbour. It has been proposed to carry on this line by Tuam to Galway, and to extend a branch from it to Loughrea. It has also been proposed to open a water communication northwards from Galway through the heart of Connaught by joining Lochs Corrib and Mask with the navigable lakes of Mayo. [CONNAUGHT.]

Prior to 1813, the only roads west of Galway were a narrow coast-road to Costello bay and a central road by Oughterard to Ballinahinch. These were led over rocks and bogs in so unskilful a manner as to be scarcely passable for any sort of carriage, and the only other means of communication through the district were narrow bridle-roads scarcely passable for horsemen in summer, and quite impracticable in winter. On the coast, in particular, there was nothing beyond the Costello better than a footpath. By the improvements begun in 1822 and still in progress under the Government, a complete line of carriage round the whole district has been effected. A coast-road has been formed which touches the heads of all the chief inlets from Costello bay to the Killery, where it joins an inland line leading through the heart of Joyce Country to the head of Loch Corrib, and thence across the central plain of Iar Connaught to the southern coast-road at Costello bay. These works and the expenditure of public money on piers and fishing harbours on the coast, have considerably promoted the general prosperity of the country; and the favourable statements of the various scientific men engaged in them have attracted so much attention to Connamara that there is a probability of its ultimately becoming the scene of extended mercantile and agricultural speculations.

Climate.—The climate is mild, and snow rarely lies in the western district. Cattle in this part of the county are never housed. The summers are wet, and the coast is exposed to very heavy storms from the Atlantic. According to the population returns for 1821, there were living in the

county of Galway at that time 21 females and 11 males severally over 100 years of age.

Geological Character.—The eastern district of Galway has not been geologically described, but, with the exception of a portion of the sandstone and clay-slate formation of the Slieve Boughta range, which it includes, and of the range of the Slieve Dert hills on the borders of Roscommon, it is understood to consist almost wholly of the same flœtz limestone tract which extends over the central plain of Ireland. The formation of the primitive district west of Lochs Corrib and Mask is better known. From Galway westward the whole coast to Slyne Head is a sheet of syenite, covered for the most part with a thin coating of bog, and containing many shallow lakes. This granite field forms a table-land of an average elevation of about 100 feet, and extends northward to the longitudinal valley which skirts the southern bases of the Twelve Pins, where it is succeeded by gneiss and mica slate, with beds of hornblende and granular limestone running east and west from Loch Corrib to Clifden. The group of Bennabola consists of a schistose quartz of a greyish brown colour, large sheets of which are exposed on the precipitous sides of all the chief eminences. On their northern bases the limestone, which shows along their southern side, disappears; and the mica slate and hornblende rise beyond Kylemore and the passes of Maam Turk into the southern mountains of Joyce Country: these are succeeded, more northward, by a transition tract of greenstone and grauwacke slate, covered by old red sandstone and conglomerate, constituting the entire country between the head of Killery harbour and Loch Mask, and extending beyond the bounds of Galway into the mountain-ranges of southern Mayo. To the westward of the Pins, the country, with the exception of the hill of Renvyle, which is a mass of quartz, consists principally of mica slate traversed by beds of granular limestone, and in some places by veins of granite. To the east the range of mountains rising from the northern edges of the granite tract terminate in the hill of Glen over Oughterard. All the formations of the district enter into the structure of this hill. On the west it is composed of quartz, and on the north of mica slate: granite and syenite constitute its eastern and southern faces, and the centre is penetrated by beds of hornblende and granular limestone with a capping of greenstone; which last rock also constitutes the mass of Ben Leva, and enters largely into the formation of the range of Maam Trasna. The line of demarcation between this primitive district and the flœtz limestone field of the eastern division of the county, pretty nearly coincides with the high road from Galway to Oughterard, north of which it enters the bed of Loch Mask, which it traverses and is again observable running northward and westward into the south of Mayo.

The mountains of the primitive district are highly metalliferous. The neighbourhood of Oughterard is rich in copper and lead; and abundant indications of the same ores have been found throughout the group of Bennabola. Fine green marble is quarried at Ballinahinch at the southern base of the same mountains, and the black and variegated marbles of Anglihan and Merlin Park near the town of Galway are of a superior quality. In the eastern district ironstone has been found at Woodford, Gort, and Lawrencetown: the works at the first place were carried on extensively at one time; but the supply of wood for smelting having been exhausted, they have been long since given up. Manganese is of frequent occurrence in the district about Gort, particularly in the neighbouring mountain of Slieve-an-oir (or 'the Gold Mountain') on the Clare boundary. Potters' clay and yellow ochre occur in the country about Athenry. A fine grit, fit for millstones, is raised near Dunmore; and the Slieva Boughta mountains above Loughrea afford an excellent stone for polishing marbles.

Agriculture.—The richest soil in this county occurs in a tract extending from Gort through Loughrea to Portumna, Eyre Court, and Ballinasloe. The wheat produced in the southern portion of this tract is of a superior quality; and the numerous demesnes lands occurring throughout it are among the most fattening pastures in Ireland. The remainder of the eastern district is more an oat and barley country, the best of which extends northward from Tuam to Dunmore and Shruel. On the lighter soils great numbers of sheep are fed, principally for the supply of the Leinster graziers, who purchase them for fattening, at the fairs of Ballinasloe. Throughout this district marl is of frequent occurrence. The only tract of cultivated ground of any considerable extent west of Galway is that which extends along the verge of the limestone plain to Oughterard. The improvements about Clifden, Ballinahinch, and Renvyle extend but a short way into the surrounding waste. Throughout the entire county of Galway, with the exception of demesnes, the dry-stone wall is the prevailing fence.

Large quantities of bog have from time to time been reclaimed. Experiments are now in progress on the bog of Critt, part of the estate of Lord Clonbrook, by which it appears that an outlay of about 14*l*. per acre is sufficient for the complete reclaiming of ordinary bog-lands in Galway.

Some resident proprietors have adopted the system of green crops, and conduct their farming on the Scotch and English plan; but these are very rare exceptions. An estimate of the amount and distribution of agricultural produce may be formed from the following table of the sales of grain for the year 1835 at each of the under-named towns. In order to afford an estimate of the increase or decrease of such sales in each, the total amount so sold within the ten years preceding is added:—

	For year 1835.			Total for 10 years preceding 1835.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Ahascragh	60	48	455	420	336	3,195
Ballinasloe	780	312	2,502	6,435	2,756	21,226
Ballygar	..	..	910	..	..	9,100
Clifden	..	150	289	..	480	863
Creggs	..	..	546	..	..	5,460
Dunmore	..	..	1,680	..	..	14,960
Eyrecourt	21	58	1,365	210	580	13,650
Galway	11,448	2,601	15,902	157,440	26,947	113,929
Gort	600	45	436	4,969	575	3,894
Kinvarra	395	280	315	2,971	2,342	2,710
Laurence-town	..	..	68	..	..	680
Loughrea	..	..	3,325	..	..	33,250
Monivae	88	1	700	437	9	3,926
Mount Bellew	825	..	1,274	3,250	..	12,740
Portumna	2,838	369	542	21,856	3,606	6,135
Tuam	468	364	2,340	4,680	3,640	23,400
Woodford	125	..	227	1,036	..	1,984
Total for County	17,148	4,228	32,875	203,704	41,281	271,098

The produce in live-stock of Galway cannot be so accurately estimated, as Ballinasloe, the great fair for cattle within this county, is frequented by sellers from all the western parts of Ireland. At the October fair here, as many as 20,000 head of black cattle and 90,000 sheep have been sold within the week: the average value of cattle annually brought to sale has been estimated at 400,000*l*.

Fisheries.—The fisheries of the coast yield a very considerable produce. About sixty-three thousand long thousands (or eighty-five millions) of herrings appear to have been disposed of to country dealers and resident curers in Galway in the year 1836; which, at 10*s*. the long thousand, would yield the fishermen alone 31,500*l*. In the same year the total number of fishermen employed on the Galway coast was 8539, manning 1 decked vessel, 116 half-decked ditto, 479 open sail-boats, and 1376 row-boats. Besides the herring fishery, there is an excellent take of cod, ling, whiting, and turbot, from December to March; and of gurnet, mackerel, bream, and pollock, from May to August, together with a copious supply of oysters, lobsters, and crabs. The sun-fish deep-sea fishery peculiar to this coast deserves special mention. The sun-fish or basking-shark has its name from only appearing about sunrise and sunset, at which times it is distinguishable by its tail and back-fins protruding from the water. It is killed with the harpoon like a whale; and as the average bulk is thirty feet in length, and six tons in weight, it requires five or six men for three hours or more to kill a single fish. The oil yielded by the liver of an average-sized sun-fish is worth about 50*l*. To carry on this fishery with advantage, the boats should be decked vessels of from 40 to 80 tons, well-found, and capable of remaining at sea in all ordinary weathers; but, as there are none such in use among the fishermen of the coast, the pursuit of this profitable branch of industry has almost entirely ceased.*

* The manufacture of Kelp was formerly another source of considerable profit to the inhabitants of the shores: but owing to the decline in the price of barilla, it is not now so much attended to; and the use of the seaweed as manure is likely to prove more generally beneficial. The manufacture of coarse woollen hosiery also brings a return of about 10,000*l*. per annum into Connamara; and coarse linens and friezes are made to a large extent for home consumption.

The general condition of the people of Galway is somewhat better than that of the inhabitants of most other parts of Connaught, which probably arises from the residence of so many of the landed proprietors on their estates: 6*d.* to 8*d.* per day for 120 days in the year is the average rate of agricultural wages and employment. The manners of the people west of lochs Corrib and Mask are very primitive; and some of the clans still inhabiting the mountainous tract north of Oughterard and the Twelve Pins are remarkable for great stature and personal strength. The Irish language is very generally spoken.

Political Divisions.—Galway is divided into seventeen baronies, of which three are situated west of lochs Corrib and Mask: viz., Ross, nearly co-extensive with the district of Joyce Country, which contains but two small villages; Ballinahinch, nearly co-extensive with the district of Connamara, containing the town of Clifden (population, in 1831, 1257), and Moycullen, corresponding with the district of Iar-Connaught, which contains the village of Oughterard, with a population of 527. East of lochs Corrib and Mask the district bordering on Mayo is occupied by the baronies of Clare, containing the town of Headforth (population 1441), and part of the town of Tuam (total population 6883) [TUAM]; Dunmore, containing the town of Dunmore (population 847), and part of Tuam; and Tyaquin, containing no hamlet with more than 60 inhabitants: the district bordering on Roscommon is occupied by the baronies of Ballymoe and Killian, containing only hamlets; Kilconnell, containing the towns of Ahascragh (population 851) and Aughrim (population 587); and Clonmacnoon, containing part of the town of Ballinasloe, total population 4615: the district bordering on the Shannon has the baronies of Longford, containing the towns of Eyre Court (population 1789) and Portumna (population 1122); and Leitrim, containing only the village of Leitrim, of 280 inhabitants: the district extending from the centre of the county to the head of Galway bay and to the Clare boundary has the baronies of Athenry, containing the town of Athenry (population 1309); Loughrea, containing the town of Loughrea (population 6289); Dunkellin, containing the town of Oranmore (population 673); and Kiltartan, containing the towns of Gort (population 3627) and Kinvarra (population 824); the islands of Arran constitute a barony and parish in themselves.

Galway county is represented in the Imperial Parliament by four members, viz. two for the county, and two for the county of the town of Galway. The county constituency in 1836 was 3057.

Table of Population (exclusive of County of the Town of Galway).

Date.	How ascertained.	Houses.	Families.	Families chiefly employed in agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other families not comprised in the two preceding classes.	Males.	Females.	Total.
1792	Estimated by Dr. Beaufort .	28,212	..	..	..	..	..	..	142,000
1813	Under Act of 1812 . . .	21,122	..	..	..	..	..	..	140,995
1821	Under Act 55 Geo. III. c. 120	54,180	57,142	..	..	..	156,157	153,442	309,599
1831	Under Act 1 Wm. IV. c. 19 .	62,508	65,986	51,448	6,950	7,588	189,204	192,360	381,564

Civil History.—The Anglo-Norman family of De Burgho and their followers, in the beginning of the thirteenth century, fixed themselves chiefly about Athenry and Galway, and maintained the administration of English law until the middle of the next century, when the assassination of William earl of Ulster [BELFAST] led to a revolt of the entire Connaught branch of the De Burgho family. The De Burghos of Galway, having assumed the Irish name of Mac William Eighter, to distinguish them from the Mac Williams Oughter, another branch of the same family, fell into the lawless practices of the neighbouring clans, and remained in all respects like native Irish till the reign of Elizabeth. English law was again introduced by the reduction of this county to shire-ground by Sir Henry Sidney in 1585; but the Irish mode of life continued to prevail until after the rebellion of 1641, and the war of the revolution of 1688, both of which events affected the property and population of this county to a great extent. The present proprietary are for the greater part of English descent; but the great mass of the population are the descendants of old Irish. The family of Joyce, which still forms the chief population of the barony of Ross, and are quite Irish both in language and manners, are said to be descendants of English adventurers, who settled here in the reign of Edward I.

Galway is very rich in antiquities. There are round towers at Ballygaddy, Kilbannon, Kilmacduagh Meelick, Murrough, and Ardrahan. Cromlechs and stone circles are of frequent occurrence. The antiquities of the episcopal seats of Tuam, Clonfert, and Kilmacduagh are contained within this county. Of the numerous remains of religious houses throughout Galway, the ruined abbey of Knockmoy is the most interesting. It was founded in the year 1189 by Cathal O'Connor, surnamed Crove-dearg, or 'of the red hand,' in consequence of a victory obtained by him over the English under Almeric St. Laurence. Above the tomb of the founder are some fresco paintings of great interest, as exhibiting the costume of the antient Irish: the Phrygian cap represented as worn by some of the figures will attract the attention of the antiquary. Abbey Knockmoy is also interesting for its architecture, which indicates a considerable advancement in the arts among its founders. The raths or earthern fortresses of the old Irish, and castles of the early Anglo-Norman lords, are also very numerous.

For the present state of education in this district see TUAM.

The county expenses are defrayed by grand jury assessment. The amount so levied in the year 1835 was 43,938*l.* 8*s.* 7*d.*

The constabulary force employed in Galway in the year 1835 consisted of 12 chief constables, 122 constables, 540 sub-constables, and 15 horse police, the total expense of which force was 23,553*l.* 19*s.* 8*d.* In 1835 the police force for this county consisted of one stipendiary magistrate, 13 chief constables, 135 constables, 582 sub-constables, and 19 horse; the total expense of this establishment was 26,565*l.* 6*s.* 9*d.*, of which 12,480*l.* 16*s.* 6*d.* was defrayed by the county.

The district lunatic asylum for Galway and the other counties is at Ballinasloe: it was opened in 1833, and accomodates 150 patients. (*Statistical Survey of the County of Galway*, Dublin, 1824; *Reports of Commissioners of Irish Bogs*; *Reports of Commissioners of Irish Fisheries*; Inglis's *Ireland*; *Letters from the Irish Highlands*, &c.)

GALWAY, County of the Town of, was erected into a separate county by charter of 8th James I. With the exception of the site of the county gaol and court-house, the county of the town embraces a tract of 23,000 acres, and includes the parish of St. Nicholas, and parts of the parishes of Rahoon and Oranmore. This district is divided into nearly equal parts by the river, which here discharges the waters of Loch Corrib into the sea. The town of Galway is built on both sides of, and on two islands in, this river; the main town is situated wholly on the eastern side. Galway is 102 Irish or 130 English miles from Dublin.

There does not appear to have been any trace of a town here till the year 1124, when a fortress was erected on this site, probably by the O'Flaherties, dynasts of Iar Connaught, which was destroyed by Conor, king of Munster, in 1132; and, having been rebuilt, was a second time demolished by Furlough O'Brien, his successor, in 1149. On the invasion of the English in 1180, Galway was again put in a state of defence by the O'Flaherties, from whom Richard De Burgho took it in 1232; and in 1270 the walling and fortification of the town were undertaken by the con-

querors. About this time the ancestors of many of the present leading families of Galway settled here, and from the entry of customs on the Pipe roll, it appears that the place at this time had already become a considerable depôt of foreign merchandize.

The power of the new settlers being confirmed by their victory at Athenry over the Irish, who had risen in aid of Edward Bruce on his invasion in 1315, the town, notwithstanding some interruption caused by the defection of the De Burghos in 1333, continued to prosper; and various subsequent grants of murage attest the importance which was attached to its preservation by the English government.

Although involved in frequent disputes with Limerick, arising out of the rivalry of trade, Galway continued to increase in mercantile prosperity till the middle of the seventeenth century. On the breaking out of the rebellion in 1641, the Earl of Clanricarde, after some opposition, occupied the town for the king. The concourse of persons taking refuge here from the troubles which succeeded produced a plague, which, between July and April, 1649, carried off 3700 of the inhabitants. On the final success of the Parliamentarians in 1652, Galway, after enduring a blockade of some months, submitted to Sir Charles Coote. On the breaking out of the war of the revolution in 1688, the inhabitants declared for James II., and continued attached to his cause until the defeat of the Irish at Aughrim enabled General Ginckle to come before the town with a force of 1400 men, to whom the place surrendered on honourable terms on 26th July, 1691. From this period down to the present time Galway has continued distinguished for its attachment to the established government, which was markedly evinced by the loyal services of the inhabitants during the rebellion of 1798.

The walls, which formerly contained an area of about twenty-two acres, have been almost entirely pulled down since 1779, and the town has now extended on all sides to a considerable distance beyond its former limits. Some of the antique residences still remain, which are generally square castellated buildings, with an interior court-yard and arched gateway opening on the street, in the Spanish taste. The whole of the old part of Galway, indeed, partakes of the appearance of a Spanish town, the result most probably of the extensive trade and intercourse maintained between it and the coast of Spain. The house of James Lynch Fitzstephen, who was mayor in 1493, and whose determined execution of the law upon his own son has given much interest to his memory, still stands in Lombard-street, commonly called 'dead man's lane,' in allusion to the event above referred to. The west bridge, built about 1442, connects the town with Ballymana island and the opposite suburbs.

The corporation of Galway consists of a mayor, two sheriffs, free burgesses unlimited, recorder, and town-clerk. The corporate authorities have exclusive criminal jurisdiction within the town, and a civil jurisdiction to any amount for debts contracted within the same limits. The borough quarter-sessions are held four times a year, and petty sessions two days in each week. The earliest charter extant is of 19th Richard II.; but this and other subsequent charters were reformed by the new rules of 25th Charles II., and by the present governing charter of 29th of the same reign. [CORPORATIONS OF IRELAND, p. 49.] The revenue of the corporation arises wholly from the tolls of the town, which in the year 1836 were let for 1260*l.* per annum.

This corporation has the patronage of a singular ecclesiastical body called the Royal College of Galway, which originated in a desire of the inhabitants to free themselves from the diocesan jurisdiction of the Irish archbishops of Tuam. This was carried into effect by a release executed in 1484 by Donat O'Murray, the then archbishop, which was subsequently confirmed by Pope Innocent VIII., and ratified by charter of 5th Edward IV.; erecting the church of St. Nicholas into a collegiate body, consisting of a warden and eight vicars choral, whose presentation and election lie wholly with the corporation. By the 15th section of 11 Geo. IV., c. 7, this privilege is now confined to the Protestant members of that body. The wardenship of Galway extends over the parishes of St. Nicholas, Rahoon, Oranmore, Clare-Galway, Moycullen, Kilcommon, Ballynacourty, and Shruel, and contains a total population of 68,145. Galway is represented in the Imperial Parliament by two members. The constituency in 1836 was 2064.

The port and harbour are under the control of commissioners acting under 1 and 2 William IV., c. 54. The harbour dues are at present let for 1260*l.* per annum; and on security of this revenue the commissioners have borrowed from the Board of Public Works a sum of 17,000*l.* for various improvements on the harbour now in progress. The mayor of Galway is *ex officio* admiral of the coasts of Galway bay as far as the isles of Arran.

The borough gaol erected in 1810 is situated on the upper of the three islands which the river here forms; and adjoining it is the county gaol, connected by a bridge, built in 1831, with the county court-house, a handsome cut stone building erected in 1815, with a portico of four Doric columns. The gaol is built on the semicircular model, and is kept in an excellent state of discipline. The borough court-house or Tholsel, erected during the civil wars of 1641, is a respectable edifice: the under part forms an extensive piazza.

Opposite the Tholsel, in the middle of the only plot of ground within the limits of the old walls, stands the collegiate and parish church of St. Nicholas, founded in 1320, by much the most imposing building in this county, if the lately-erected Roman Catholic cathedral of Tuam be excepted. It is of a cruciform shape, and extends in length 152 feet by 126 feet in breadth, including the side aisles; the height to the vault-nave is 42 feet 10 inches. From the intersection of the circles rises the tower, to which the steeple was added in 1633. In the interior are various monuments of interest still retaining many traces of sumptuous embellishment. The style of the building is the pointed Gothic. A sum of 1385*l.* has been recently granted by the Ecclesiastical Commissioners for its repair. The disposition of the streets within the circuit of the antient walls is very irregular; but in the newly-built portion of the town, particularly in the direction of the county court-house, uniformity and airiness have been more consulted. The custom-house, built in 1807, is a plain building. There are two barracks with accommodation for about 500 men.

This portion of the town is built on a gently-rising eminence stretching down to the river on the west, and to the sea on the south: on the latter side a creek of the bay forms a natural harbour, which is the site of the docks now in progress. These docks will occupy about nine acres, with water for vessels of 500 tons. The spit of land which separates this basin from the river is quayed for a distance of 1300 feet, and terminates in a return pier. There are also two small docks on the river side of the town, which constituted the quays for merchant vessels during the old period of its continental trade. A small open space adjoining is still called Spanish Parade.

On the western side of the river is the extensive suburb of Claddagh, which was a very filthy village until 1803, when Captain Hurdis, of the navy, at that time stationed on the coast, persuaded the fishermen by whom it is exclusively occupied to set apart a portion of their earnings for the paving and cleansing of their streets; and the Claddagh is now in this respect superior to many parts of the town itself. The inhabitants will not permit strangers to reside among them. The laws of their fishery and most of their internal regulations are under the control of a functionary whom they call their mayor, and elect annually. They all speak the Irish language, and the women still retain more of the Irish costume than is observed in any equally accessible district. In 1820 the number of their open sailing-boats was stated to be 250. In 1836 they are stated at 105, employing 500 men, with 80 row-boats employing 320 men. The entire population of this suburb, which is on the increase, is estimated at about 6000.

Although by the act of 2 Geo. II., c. 13, s. 19, the corporation are specially empowered to levy a tax for the lighting of the town, as well as the inhabitants generally by 9 Geo. IV., c. 82, neither of these acts has yet been put in force. Gas-works are however at present in progress of erection. The paving of the streets has been greatly neglected; and at night they have hitherto been left unprotected by any police. The fuel chiefly used is turf, which is brought in large quantities from the neighbouring coasts of Iar-Connaught and Connamara. The average price of coal is about 20*s.* per ton; but this is an article, the price of which fluctuates with the weather, and sometimes rises to a guinea and a half per ton.

The chief manufacture of Galway is flour, which, owing to a fall of fourteen feet in the waters of Loch Corrib, between that lake and the sea, has been carried to a very considerable extent. In 1820 there were twenty-three flour-mills, six oat-mills, two malt-mills, and three fulling-mills, driven by this water-power. The quantity of wheat ground and dressed at this time was estimated at 12,000 tons per annum, and the trade has since increased. There are a bleach mill and green on one of the islands, and an extensive paper-mill and several breweries and distilleries in the town.

The export of wheat, oats, and flour has, it is stated, trebled within the fifteen years preceding 1834. The exports from 1st September, 1833, to 5th July, 1834, consisted of 6018 tons of wheat, chiefly to Liverpool; 7212 tons of oats, chiefly to London; 1554 tons of flour; 406 tons of barley; and 50 tons of oatmeal. Besides this there is an export of kelp, marble, wool, and provisions. The imports consist of timber, wine, coal, salt, hemp, tallow, and iron. The following table exhibits the progress of trade during the last ten years:—

Year ending 5th Jan.	Custom Receipts in Port of Galway.			Vessels Inwards.		Vessels Outwards.	
	£.	s.	d.	No.	Tonnage.	No.	Tonnage.
1824	13,951	8	2	73	6,856	127	11,932
1825	17,308	2	5	156	13,169	150	11,536
1826	23,324	9	5	157	12,866	156	13,297
1827	29,913	7	8	140	12,992	140	10,132
1828	35,784	10	0	132	12,451	133	11,346
1829	40,109	18	6	129	14,251	153	14,562
1830	48,564	6	4	148	13,830	150	12,861
1831	36,260	8	3	132	14,006	107	10,936
1832	35,183	1	4	110	9,991	136	13,297
1833	27,755	4	8	112	11,577	136	14,398

In 1835 the customs had increased to 31,133*l.* 2*s.* 5*d.*: the vessels inward numbered 135, of an aggregate burthen of 12,915 tons; vessels outward 145, with a tonnage of 15,531. In the same year the excise duties for this district amounted to 50,154*l.* 12*s.* 5*d.*

Table of Population.

Date.	How ascertained.	No. of Houses.	No. of Families.	Families chiefly employed in Agriculture.	Families chiefly employed in Trade, Manufactures, and Handicraft.	Families not included in preceding classes.	Males.	Females.	Total.
1813	. . . . . .	3,353	..	..	..	..	..	..	24,684
1821	Under Act 55 Geo. III. c. 120.	3,957	6,238	..	..	..	13,346	14,429	27,775
1831	Under Act 1 Wm. IV. c. 19.	4,606	6,258	2,642	1,307	2,309	15,487	17,633	33,120

The number of young persons receiving instruction in the wardenship of Galway in 1834 was 2827, of whom 1763 were males and 1064 females. The majority receive their instruction from the Roman Catholic religious orders, who are more numerous in Galway than in any other part of the British empire. There are monasteries of the Dominican, Franciscan, and Augustin orders for men, with an equal number of nunneries of the same orders, together with a Patrician monastery, in which is a school, in connection with the National Board of Education, of 799 boys; two convents for nuns of the Presentation order, in one of which there is a school, also in connexion with the same Board, for 529 girls; and a Magdalen asylum. Two of the other schools within the wardenship are in connexion with the National Board.

There are four newspapers published in Galway, to which 39,810 stamps were issued in the year 1835. There are two subscription news-rooms and a library; but in 1834 there was no regular bookseller's shop in the town.

The expenses of the county of the town are defrayed by grand jury assessments, which, for the year 1835, amounted to 5,701*l.* 8*s.* 3*d.* The constabulary force in the same year consisted of one chief constable and twenty men, the expense of maintaining which amounted to 854*l.* 19*s.* 5*d.*, of which 413*l.* 19*s.* 7*d.* was chargeable against the county of the town. (Hardiman's *History of Galway*, Dublin, 1820; *Statistical Survey of Galway;* Inglis's *Ireland in* 1834; *Parliamentary Returns, &c.*)

GAMA, VASCO DE, the first European navigator who found his way to India by doubling the Cape of Good Hope, was born at the small seaport town of Sines in Portugal. The date of his birth, and the circumstances of his early life, are not mentioned. It appears that he was in the household of Emanuel king of Portugal, and having devoted himself to navigation and discovery, was appointed to the command of an expedition which was to seek its way to the Indian Ocean by sailing round the southern extremity of Africa. The notion of this passage was by no means a new one, and when it was taken up by the Portuguese sovereign its practicability had been pretty well established. In 1487 Pedro de Covilham set out for India by way of the Mediterranean, the isthmus of Suez, and the Red Sea, and he was accompanied as far as Egypt by Alfonso de Payva, who then left him to go in search of 'Prester John,' a great Christian king, who, after being sought for in various countries, was now reported to be living in a high state of civilization in the eastern parts of Africa. [ABYSSINIA.] Before their departure from Portugal, Calsadilla bishop of Viseu gave these travellers a map of Africa, in which that continent was correctly described as being bounded on the south by a navigable sea. This map, or the materials for it, had probably been procured from the trading Moors of North Africa, to whom the Portuguese had long before been indebted for much information concerning that continent.

Payva added little to geographical knowledge; but Covilham crossed the Indian Ocean, visited Goa, Calicut, and other places on the coast of Hindostan, acquired an exalted notion of the trade and wealth of those parts, and on his return towards the Red Sea he obtained from Arabian mariners some information concerning the eastern coast of Africa as far as Sofala on the Mozambique Channel. Soon after his return he visited Abyssinia, where he was detained by the government for some thirty years. Shortly after arriving in that country he found means of forwarding letters to the king of Portugal, in which he stated that no doubt existed as to the possibility of sailing from Europe to India by doubling the southern point of Africa, and he added that that southern cape was well known to Arabian and Indian navigators. The reports of Covilham, and the well-known importance of the trade with India, greatly excited the Portugese, who moreover had long been pursuing discovery on the western coast of Africa; and in the course of this, the fifteenth century, they had gradually extended their researches from Cape Non, in lat. 28° 40′ N., to Cape Cross, or de Padrono, in lat. 22° S. At the end of December, 1487, Bartholomew Diaz had returned to Lisbon after discovering 300 leagues of coast, and correctly laying down the great Cape, which he doubled in a storm without knowing it, but which he had properly recognised on his return. [AFRICA.] Vasco de Gama sailed from Lisbon on the 8th of July, 1497, five years after the discovery of the New World by Columbus. The royal squadron which he commanded consisted only of three small vessels, with sixty men in all. The Cape of Good Hope seemed to merit the name which had been given it by Diaz—Cabo Tormentoso. Dreadful tempests were encountered before reaching it, the winds were contrary, and their fears and their sufferings caused a mutiny among the sailors, who tried to induce Gama to put back. But the firmness of the commander quieted the apprehensions of his men, and on the 19th November, with a stormy sea, he doubled the Cape and turned along the eastern shore. [AFRICA.] On reaching the African town of Melinda, which belonged to a commercial and civilized people, a branch of the great race of Moors or Arabian Mohammedans, he found several Christian merchants from India, and he also procured the valuable ser-

vices of Malemo Cana, a pilot from Guzerat. This man was a skilful navigator: he was not surprised at the sight of the Astrolabe, or at their method of taking the meridian altitude of the sun. He told them that both the instrument and its uses were familiar to the mariners of the Eastern seas. Under the guidance of this pilot Gama made the coast of Malabar in twenty-three days, and anchored before Calicut on the 20th of May, 1498, then a place of considerable manufactures and foreign trade, which was chiefly in the hands of Moors or Arabs. Gama opened communications with the zamarin or sovereign prince of Calicut, who, after some negotiation, agreed to receive him with the honours usually paid to an ambassador.

The sailors, who were well acquainted with the character of the Moors, feared that if their commander put himself in their power he would fall a victim to their treachery and jealousy. The officers also and his brother Paul strongly dissuaded him from landing. But Gama was resolved. Arming twelve of his bravest men, he went into his boat, strictly charging his officers, in case he should be murdered, to return immediately to Portugal and there announce to the king the discoveries made, and his fate. On landing he was received with great pomp and ceremony by the natives, who conducted him through the town to a house in the country, where on the following day the zamorin granted him an audience. At first his reception was very favourable, but the tone of the prince soon changed; a circumstance which the Portuguese attribute to the intrigues of the Moors and Arabs, who were jealous of the new comers. The ill-humour of the zamorin was not soothed by an unlucky omission. Gama had not brought any suitable presents, and the few paltry things he offered were rejected with contempt by the officer appointed to inspect them. Whatever may have been the designs of the zamorin against the Portuguese, Gama, it is said, at last succeeded in convincing him of the great advantages he might derive from a commercial and friendly intercourse with the Portuguese; and he certainly was allowed to get back to his ships in safety. As soon as he was on board he made sail, and after repairing his ships at the Angedive Isles, on the coast a little to the north of Calicut, he again stood across the Indian Ocean. He touched at Magadoxa, or Mukdeesha, on the eastern coast of Africa and nearer to the Straits of Bab-el-Mandeb than he had gone on his outer voyage. He next anchored at Melinda, and took on board an ambassador from the Mohammedan prince of that place. He arrived at Lisbon in September, 1499, having been absent about two years and two months. His sovereign received him with high honours, and conferred on him the sounding title of Admiral of the Indian, Persian, and Arabian seas. This voyage of Gama is a great epoch in commercial history: it showed the nations of the West the sea-road to the remote East; it diverted the trade of the East from the Persian Gulf, the Red Sea, Asia Minor, Egypt, and Italy, the routes in which it had run for 1400 years; and it led ultimately to the establishment in India of a vast empire of European merchants. The effect it had upon Italy was most disadvantageous, and though there were other causes at work, the decline of the great trading republics of Venice and Genoa may be traced to the discovery of the passage to India by the Cape of Good Hope. Soon after Gama's return Emanuel sent out a second fleet to India, under the command of Pedro Alvares de Cabral. The most remarkable incident of this voyage was the accidental discovery of Brazil. [BRAZIL, vol. v. p. 369.] From Brazil however the little fleet got to India, and Cabral established a factory at Calicut—the first humble settlement made by the Europeans in that part of the world. But Cabral had scarcely departed when all the Portuguese he left behind were massacred by the natives or Moors, or by both. The Portuguese government now resolved to employ force. Twenty ships were prepared and distributed into three squadrons; Gama set sail with the largest division, of ten ships—the others were to join him in the Indian seas. After doubling the Cape, he ran down the eastern coast of Africa, taking vengeance upon those towns which had been unfriendly to him during his former voyage. He settled a factory at Sofala, and another at Mozambique. On approaching the coast of India he captured a rich ship belonging to the Soldan of Egypt, and after removing what suited him he set fire to the vessel; all the crew were burned or drowned, or stabbed by the Portuguese. He then went to Cananore, and forced the prince of that country to enter into an alliance with him; on arriving at Calicut, the main object of his voyage, he seized all the ships in that port. Alarmed at his display of force—for Gama had been joined by some of the other ten ships—the zamorin condescended to treat; but the Portuguese admiral would listen to no propositions unless a full and sanguinary satisfaction were given for the murder of his countrymen in the factory. Gama waited three days, and then barbarously hanged at his yard-arms fifty Malabar sailors whom he had taken in the port. On the next day he cannonaded the town, and having destroyed the greater part of it, he left some of the ships to blockade the port, and sailed away with the rest to Cochin, the neighbouring state to Calicut. These neighbours being old enemies, it was easy for Gama to make a treaty with the sovereign of Cochin, whom he promised to assist in his wars with Calicut. It is not quite clear whether a war existed at the time, or whether Cochin was driven into one by the manœuvres of the Portuguese; and according to some accounts, Gama only renewed a treaty which had been made by Cabral two years earlier. It was Gama however who first established a factory in Cochin, at the end of 1502. In the following year, the Alburquerques obtained permission to build a fort on the same spot; the Portuguese then became masters of the port and the sea-coast, and Cochin was thus the cradle of their future power in India. Gama left the zamorin of Calicut with a war with Cochin on his hands; and five ships remained on the coast of Malabar to protect the settlement. The admiral arrived at Lisbon with thirteen of the ships in the month of December, 1503. The court created him Count of Videqueyra. Gama however was not re-appointed to the command in India, where the career of conquest was prosecuted by Alburquerque, Vasconcellos, and others. In 1524, eight years after the death of the great Alburquerque, Gama, who had been living quietly at home for nearly twenty years, was appointed viceroy of Portuguese India, being the first man that held that high title. He died in December, 1525, shortly after his arrival at Cochin. His body was buried at that place, and lay there till 1538, when, by order of John III., his remains were carried to Portugal.

Vasco de Gama was a brave and skilful man, but owing to several circumstances his fame has been raised somewhat above his real merits. The main cause of this is probably to be found in the great national poem of the immortal Camoens, of a portion of which Gama is the hero, the adventures of his first voyage to India being described with even more than the usual brilliancy and amplification of poetry. (Barros, *Decades;* Castanheda and Lafitau's *Hist. Conqu. Portug.;* Cooley's *Hist. Mar. Discov.;* Camoens.)

GAMBIA, a river in Western Africa, whose embouchure is situated betwen 13° and 14° N. lat. and near 16° W. long. The upper course of this river has not been visited by European travellers; but according to information obtained from natives its source seems to be on the northern declivity of the mountain region which occupies nearly the whole country between the Sahara and the coast of Guinea, near the place where the 11th northern parallel is cut by 9° W. long. More than one half of its course lies through the mountain region itself. Where it begins to emerge from the mountains and enters the hilly country, which separates them from the plain along the shores of the Ocean, it receives on the right a considerable branch, the Nerico, which comes down from Bondoo with a south-western course. Up to the confluence with this river the Gambia seems to run in a west-north-western direction, but soon afterwards it turns due west, and continues this course to its mouth. After this change in its direction, the Gambia has a small impediment in its navigation at Baraconda, near Madina, but though it is usually called a fall, it is only a rapid which does not totally impede the passage of canoes or small boats. Up to this fall, as it seems, the tide ascends. Small sailing-vessels may go up to this point, from which to its mouth the course of the river is well known; it mostly runs through a flat country, which however for some distance is enclosed by hills and rising grounds; these heights however sink lower and lower, and disappear entirely at Kayaye, about 120 miles from the mouth of the river. The remainder of its course is through an immense plain. The flat countries along its banks are annually inundated and distinguished by their vigorous vegetation.

The English have some establishments along this river. Formerly there was one at Pisania, about 160 miles from the mouth, but it was abandoned in consequence of the an-

noyance frequently experienced from the people of Bondoo and Woolli. The farthest English establishment, we believe, is now at Jonkakonda, a little more than 120 miles from the mouth of the river. Other settlements are at St. James's and Iellifry; but the principal establishment is at the mouth of the river, the town of Bathurst, whence the produce of the country is shipped for England. [BATHURST.] The whole course of the Gambia probably exceeds 500 miles. It is called by the natives Ba Heema. (Mungo Park; Gray's *Travels in Western Africa.*)

GAMBOGE. [CAMBOGE.]

GAMBO'GIA. [HEBRADENDRON.]

GAME-LAWS were the remnant of the antient forest-laws, under which the killing one of the king's deer was equally penal with murdering one of his subjects; or, as Sir W. Blackstone somewhat quaintly expresses it, 'from this root has sprung a bastard slip, known by the name of the game-law, now arrived to and wantoning in its highest vigor, both founded upon the same unreasonable notion of permanent property in wild creatures, and both productive of the same tyranny to the commons; but with this difference, that the forest-laws established only one mighty hunter throughout the land, the game-laws have raised a little Nimrod in every manor.'

These laws decided what birds and beasts should be deemed game, prohibited all persons not duly qualified by birth or estate from killing any of such prohibited creatures, or even from having them in their possession as articles of food, and inflicted severe punishments and penalties upon the offenders against their provisions.

During the operation of the game-laws the gaols were filled with offenders against them, and profligate habits were induced, violence was committed, and misery of the most dreadful description was caused by the temptations to violate these enactments. Yet the landed proprietors continued to support the obnoxious system, regardless of the evil it produced; jealousies were created among themselves, and the most notorious injustice was perpetrated before individual magistrates and the courts of quarter-sessions, who could hardly be expected to judge offenders against their own cherished privileges with impartiality; until at last the legislature was compelled to interfere, and by a statute passed in 1831, 1 and 2 William IV. c. 32, the old system was materially improved. The whole of the former provisions respecting qualification by estate or birth were removed, and any person obtaining a certificate is now enabled to kill game, either upon his own land or on the land of any other person with his permission.

The sale of game is under certain restrictions legalised; and being recognised as an article of legal traffic, the statute very properly provides some more summary means than those previously in force for protecting it from trespasses. Poaching in the night-time still remains punishable by imprisonment for the first two offences, and by imprisonment or transportation for the third.

For the purposes of this statute the word Game is declared to include hares, pheasants, partridges, grouse, heath or moor game, black game, and bustards; and the periods during which the different species of game may not be killed is declared, such periods being the breeding and rearing seasons of the different species; and penalties are imposed upon persons laying poison for game, or destroying the eggs of any bird of game, or of any swan, wild duck, teal, or widgeon, or knowingly having possession thereof.

The penalty imposed by the above statute for killing game without a certificate in the day-time is 5*l.* for each offence; and trespassers, even if licensed to kill game, may be fined 2*l.* with costs, or if in greater number than five persons, 5*l.* each, and the game killed may be demanded and taken from them. The penalties were made recoverable in a summary way before two justices of the peace, and if the party trespassing refuses to give his name and address, he may be apprehended and taken before a justice of the peace by the person entitled to the game, or the person entitled to the land, or any person authorized by either of them.

Gamekeepers are persons authorized by lords of manors or reputed manors to kill game; but the authority does not extend beyond the limits of the manor, though a gamekeeper may be appointed for any number of manors; the restriction indeed is rarely, if ever, insisted upon. The object of all game-laws being the preservation of game, it seems sufficiently attained by the prohibition to kill game during the breeding and rearing seasons. All persons having an equal right, under certain restrictions, to kill game during the rest of the year, have in fact an interest in enforcing the observance of the laws.

Though not coming strictly under the usual meaning of the term game-laws, we may mention that the salmon-rivers are closed during a certain specified period of the year, being the spawning season; a regulation considered necessary to preserve the breed of fish, and also because at that season the flesh is not wholesome for food. (4 Bl. *Com.*; Deacon *on the Game-Laws.*)

GAMING, or GAMBLING, is an amusement, or we might properly call it a vice, which has always been common in all civilized countries and among all classes, but more particularly the rich and those who have no regular occupation. But a passion for gaming is not confined to the nations called civilized: wherever men have much leisure time and no pursuit which will occupy the mind and stimulate it to active exertion, the excitement of gaming, which is nothing more than the mixed pleasure and pain arising from the alternations of hope and fear, success and failure, is a necessity which all men feel, though in different degrees according to the difference of temperament. The Germans, says Tacitus, stake their own persons, and the loser will go into voluntary slavery, and suffer himself to be bound and sold, though stronger than his antagonist; and many savage nations at the present day are notoriously addicted to gambling. Gaming has been described by Cotton, an amusing author who wrote in the beginning of the last century, as 'an enchanting witchery gotten betwixt idleness and avarice.' Besides the pleasure derived from the excitement that attends games of chance, there is no doubt that the desire to enjoy without labour is one motive which operates on a gambler: but this motive operates more on those who are practised gamesters than on those who are beginning the practice; and instances are not wanting of men strongly addicted to gaming, who have yet been indifferent to money, and whose pleasure has consisted in setting their property on a die.

In France, and many other parts of the Continent, the government has not only allowed, but has derived a considerable revenue from games of chance. In Paris, the *exclusive* right of keeping public gaming-houses was, until the year 1838, let out to one company, who paid an annual sum of 6,000,000 francs (about 240,000*l.*) for the privilege. They kept six houses, namely, Frascati's, the Salons, and four in the Palais Royal. In a recent trial in Paris, it came out in the course of the evidence, that the *clear profit* for 1837, exclusive of the duty, had been 1,900,000 francs (76,000*l.*), of which three-fourths was paid to the city of Paris, leaving the lessee 19,000*l.* for his own share. The average number of players per day was stated at 3000, and about 1000 more refused admittance. The games played were chiefly Roulette and Rouge-et-Noir, of which the latter is the favourite. It is very seldom that large sums are staked at the former, as the chances against the player are considered immense by *professional* men, a class of gentlemen who are gamblers by profession. Rouge-et-Noir is played with four packs of cards, and the 'couleur' which is nearest 31 wins; the black being dealt for first, and then the red. All the houses were open from one o'clock in the afternoon till one or two after midnight; and latterly till five or six in the morning. The highest play, especially at Frascati's, was carried on between three and six in the afternoon. Ten or twelve thousand francs were constantly lost at a sitting, and once within these few years 100,000 francs, which constituted the 'Banque' of the day, was won by a French nobleman. The actual chance of the table or 'Banque' is considered to be 7½ per cent. above that of the player, supposing the game to be fairly played, as it no doubt was in Paris, under the old system; the cards being examined and stamped by the government, and there being an agent of the police always present and ready to detect any attempted fraud on the part of the company. But admitting the game to be fairly played, the coolness of the 'croupiers' or dealers, who had no interest at stake (the whole of the losses or gains being taken by the company), and the large capital of the latter, made it absolutely impossible for the player to win, in the long run; nay, it is clear that he must lose, and that in proportion to his stake, which probably is regulated by his means. This we have heard admitted by the most constant frequenters of these houses; and nevertheless, under the influence of those causes which first lead men to gaming,

confirmed by habit and example, they still continue to indulge their passion till they are reduced to beggary, which is often followed by suicide.

That a vice which causes so much wretchedness should not merely be permitted and the practice of it superintended by the government, but that it should contribute considerably to the public revenue, has been a subject of loud complaint in France; and at last the ministers, in compliance with the desire of the Chamber of Deputies, have determined to grant no more licences after the 1st of January, 1838.

But though the intention is good, we apprehend that the determination to grant no more licences will, instead of preventing or lessening gambling in Paris, considerably increase it; and with this most pernicious difference, that instead of being carried on fairly as it is now, every kind of fraud will be practised by the illicit gaming-house keepers, in order to reap as much profit as possible before they are detected by the police. The lofty and splendid saloons of Frascati's, with their liveried servants and well dressed croupiers, will only be exchanged for miserable dens in the most infamous and retired streets of Paris, peopled by a set of ruffians who may possibly add murder to their other crimes.* In this and in many other difficult questions, as to how far and in what manner a state should interfere with the acts of its citizens, many zealous advocates for change and reform do not perceive the great distinction between making an enactment or establishing some practice with reference to a certain end, and repealing the same enactment after it has been long in force. The reasons which would be good reasons for not making such enactment, may also, either in their whole extent or to some extent, be good reasons for not repealing such enactment when once in force, or not discontinuing such practice when once established.

In England, gaming was very early the subject of penal enactments, but as a proof how futile all legislative measures hitherto made have been, we need only mention, and we do so without fear of contradiction, that there are more of those infamous places of resort, appropriately denominated 'Hells,' in London, than in any other city in the world. The handsome gas lamp and the green or red baize door at the end of the passage (as well known a sign as the Golden Cross or Spread Eagle) are conspicuous objects in the vicinity of St. James's, and of St. George, Hanover-square.

It appears that the playing at cards, dice, &c., was not punishable at common law; and an action may be maintained at law for money won at play; for the contract is not void in itself, and the winner's venturing his money is a sufficient consideration to entitle him to the action.

But if a person be guilty of cheating, as by playing with false dice, cards, &c., he may be indicted for it at common law and punished by fine or imprisonment. (2 Bac. Abr. 620.) All common gaming-houses are nuisances in consideration of law. By the statute of 33 Hen. VIII., c. 9, 'no person shall for his gain, lucre, or living, keep any common house, alley, or place of bowling, coyting, cloyth, cayls, half-bowl, tennis, dicing-table, carding, or any unlawful game, then or thereafter to be used, on pain of forfeiting 40s. a day;' and the same statute enacts that *every* person haunting and using the said houses, and playing, shall forfeit 6s. 8d.

By 16 Car. II., c. 7, any person who wins any sum of money by fraud, cosenage, deceit, &c., shall forfeit treble the value won. And by 9 Anne, c. 14, any person who shall 'at any *one time or sitting*, by playing at cards, dice, or *other game whatsoever*, or by betting on the sides of such as do play,' *lose* to any one or more persons, in the whole the sum or value of 10*l*., and shall pay the same or any part thereof, may within three months sue for and recover the same in any court of record, and after three months any other person may sue for and recover the same and treble the value thereof, with costs of suit.

By the 10th and 11th William III., c. 17, lotteries were declared public nuisances, and by several subsequent acts they have been prohibited under various penalties.

It is enacted by the 13th Geo. II., c. 19, that no horse-race shall be run for any prize of less than 50*l*. in value; and it has been decided that any wager on a horse-race made illegal by this statute is illegal also. Wagers considered contrary to decency or public policy, as on the sex or on the life of an individual, are also illegal and cannot be recovered at law or in equity. It is curious that gambling in the palace where the sovereign is residing for the time being is excepted from the statute of Anne, c. 14.

By 5 Geo IV., c. 83, persons betting, &c. in any street or open and public place, are punishable summarily as rogues and vagabonds.

A recent act (5th and 6th Will. IV., c. 41), repealing several old statutes, has altered the law relating to securities given for gaming transactions. It is enacted that in case any person shall make, draw, or execute any note, bill, or mortgage for a gaming debt, and shall actually pay to any indorsee, holder, or assignee of such note, bill, or mortgage, the sum thereby secured or any part thereof, such money shall be deemed to be paid on account of the person to whom such note, bill, or mortgage was originally given (upon the illegal consideration), and shall be deemed to be a debt due from such last-mentioned person to the person who shall so have paid such money, and shall be recoverable by action at law in any court of record.

In most parts of Germany gaming is allowed; and the magnificent saloons set apart for roulette and rouge-et-noir at Baden, Wisbaden, and other German watering-places, are well known to English travellers on the Continent. The respective sovereigns of the states in which these fashionable gaming-places exist derive an immense revenue by letting the exclusive privilege of keeping gaming establishments; and we may frequently see the grand-duke or prince playing at the table of his lessee, and losing a considerable portion of what he receives for granting the privilege.

In Italy and Spain gambling is a very common vice, especially among the lower orders, and you scarcely can find a muleteer, porter, or shoe-black, who has not a pack of dirty cards in his pocket, which he pulls out whenever he has a moment's leisure; and should he not be lucky enough to find a partner who will risk his money against him, he will frequently give a boy a trifle to play with him.

In the United States of America, but more particularly in the southern States, the practice of gambling is very common, though restrained, as we believe, in all the States by legislative enactments.

GA'MMARUS, a genus of Amphipodous Crustaceans, the *crevettes* or *cherrettes* of the French.

Generic character.—*Antennæ* inserted in front of the head between the eyes, moderate, composed of three principal joints and a fourth which is setaceous, multiarticulate and terminal; the upper antennæ with a small, setaceous, multiarticulate appendage at the internal extremity of their third joint. The four anterior *feet* terminated by a large compressed hand provided with a strong hook or moveable finger, which applies itself upon the lower edge; the four next feet terminated by a single joint, or slightly curved nail; the six last longer, raised on the sides of the body, and with a delicate and straight terminal joint. There are long, bifid, very moveable filaments on each side under the tail, which is terminated by long, ciliated appendages, which are extended nearly in the direction of the body, and which constitute a sort of spring, by means of which the animal executes considerable leaps, or aids its swimming by a backward impulse on the water. *Body* oblong, very much compressed, arched, divided into thirteen segments (including the head); each segment furnished above with a crustaceous, delicate, semi-transparent, transverse lamina or blade, and the seven first also furnished with a lateral crustaceous piece which covers the base of the feet. (Desmarest.)

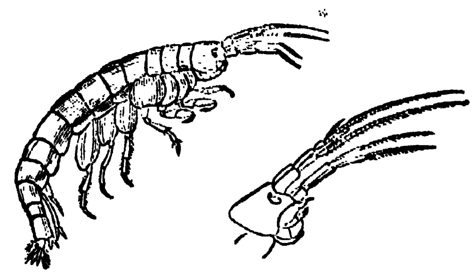
Example, *Gammarus Pulex* of Fabricius and Latreille; *Cancer Pulex* of Linnæus. *Squilla Pulex* of Degeer, *Squilla fluviatilis* of Merrett, *Gammarus aquaticus* of Leach, *Crevette des ruisseaux* of Geoffroy,—The *Fresh-water Shrimp*. This crustacean, which abounds in springs and rivulets, always swims near the bottom on its side, and its progression is principally performed by the rapid jerks of the appendages of the tail. The animal is carnivorous and feeds principally on dead fishes, and often on the carcasses of its own species. The male may often be seen swimming coupled with the female, which is much smaller, and which he holds between his legs. She keeps her eggs till they are hatched, and the young for some time seek shelter under her abdomen and the lateral appendages of her body.

There are some marine species; and Desmarest observes that the genus bears the strongest analogies to those genera which have been separated from it, in his opinion, on suffici-

* It is rumoured that Frascati's and the Salons are to be kept on, with the tacit approbation of the government.

ently slight grounds, under the names of *Leucothöe*, *Dexamine*, *Melita*, *Mœra*, *Pherusa*, *Amphithöe*, *Orchestia*, &c. The greater part of these, M. Desmarest states, have not been adopted by the more recent authors on the natural history of the Crustaceans, and the only ones which had been generally admitted when he wrote were *Talitrus* and *Corophium*. *Cerapus* of Say he considers to be founded on sufficient characters. M. Latreille however, in the fourth vol. of Cuvier's 'Règne Animal' (ed. 1829), admits them all.

Gammarus (Amphipoda) is noticed by Mr. Westwood as one of the types of each of the great groups of the typical Malacostracous Crustacea, which have been ascertained to undergo no change of form sufficiently marked to warrant the employment of the term metamorphosis. (*Phil. Trans.*, 1835.)



a, Gammarus Pulex, magnified; *b*, the head and antennæ of the same, highly magnified.

GAMMUT, in Music, signifies, in the popular sense of the word, the diatonic scale, as named either by the seven first letters of the alphabet, or by the syllables used in solmisation, *i.e.* do, re, mi, fa, sol, la, si. [DIATONIC SCALE.] And occasionally the term is applied to a single note—the G below the base clef. The word is compounded of the name of the third letter in the Greek alphabet, Γ (gamma), the final vowel being cut off, with the syllable *ut* added. In the eleventh century the antient scale was extended by the addition of a note below that sound which the Greeks called proslambanomenos (*i.e.* supernumerary), the latter answering to our A, the first space of the base staff, and the note was called *Gamm'-ut*,—that is, G *ut*, or G *do*.

The invention of the gammut in its antiquated form is generally ascribed to Guido d'Arezzo, but it now seems nearly certain that in part, if not wholly, it existed much earlier than his period. It long continued in use, and was one of the many stumbling-blocks in the path of musical students. Happily little more than the name remains; it is therefore unnecessary for us to enter further into the subject.

GANGA. [TETRAONIDÆ.]

GANGAM. [CIRCARS, NORTHERN.]

GANGANELLI. [CLEMENT XIV.]

GANGES. [HINDUSTAN.]

GANNAT. [ALLIER.]

GANNET. [BOOBY, vol. v.]

GANYME'DA (Zoology), Mr. Gray's name for a genus of radiated animals allied to the *Echinidæ* and the *Asteriidæ*, and which he thus characterizes.

Body hemispherical, depressed, thin, chalky, hollow. The back rounded, rather depressed, flattened behind, with a rather sunk quadrangular central space. The sides covered with sunken angular cavities, with a small round ring, having an oblong transverse subcentral hole in their base. Underside small, rather concave, with five slight sloping elevations from the angles of the mouth to the angles of the rather pentagonal margin. The edge simple. The mouth central. Vent none. Cavity simple. *Parietes* thin and minutely dotted: centre of the dorsal disc pellucid.

The genus, in Mr. Gray's opinion, is very nearly allied to Dr. Goldfuss's *Glenotremites paradoxus* (*Petrifact.* tab. 49, f. 9, and t. 51, f. 1), but Mr. Gray points out the differences, and is induced to consider these two genera as forming a family or order between the *Echinidæ* and the *Asteriidæ*; allied to the latter in having only a single opening to the digestive canal, and agreeing with the former in shape and consistence, but differing from it in not being composed of many plates.

Mr. Gray only knew of two specimens of *Ganymeda*, which he believes were found on the coast of Kent, as he discovered them mixed with a quantity of *Discopora Patina*, which he collected several years ago from fuci and shells on that coast. Size of specimens one-eighth of an inch in diameter. Species *Ganymeda pulchella*, Gray. (*Zool. Proc.* 1834.)

GAOL. [PRISON.]

GAOL DELIVERY. The commission of gaol delivery is directed to the justices of assize of each circuit, the serjeants and king's counsel attending that circuit, the clerk of the assize, and the judges associate. It is a patent in the nature of a letter from the king, constituting them his justices, and commanding them, four, three, or two of them, of which number there must be one at least of the judges and serjeants specified, and authorizing them to deliver his gaol at a particular town of the prisoners in it; it also informs them that the sheriff is commanded to bring the prisoners and their attachments before them at a day to be named by the commissioners themselves. Under this commission the judges may proceed upon any indictment of felony or trespass found before other justices against any person in the prison mentioned in their commission and not determined, in which respect their authority differs from that of justices of oyer and terminer, who can proceed only upon indictments found before themselves. (2 Hale, *P. C.*) [ASSIZE.]

Antiently it was the course to issue special writs of gaol delivery for each prisoner, but this being found inconvenient and oppressive, a general commission has long been established in their stead. (4 Bl. *Com.*; Hawk, *P. C.*)

GAP, a city in France, capital of the department of Hautes Alpes (High Alps), on the north-west bank of the little river Line, which flows into the Durance: 44° 34′ N. lat., 6° 5′ E. long. Gap is situated in the centre of a hollow: the neighbourhood is fertile, and the surrounding hills, naked and desolate in some parts, are in others entirely covered with vineyards. The streets of the town are narrow and ill-paved, and the houses poor: the public edifices are the cathedral, the episcopal palace, several Catholic churches and one Protestant church, the townhall, the prefect's office, the courts of justice, and the barracks. A public walk (boulevard) occupies the site of the town walls. The population of the town was, in 1831, 4572; that of the commune, 7215 in 1831, and 7854 in 1836. There are at Gap a commercial high school, a seminary for the priesthood, a museum of painting, sculpture, and antiquities, a museum of natural history, and a theatre. The diocese of Gap formerly included parts of Dauphiné and Provence: at present it consists of the department of Hautes Alpes.

Gap was in the middle ages subject to the counts of Forcalquier, and afterwards to its own bishops, who had the title first of princes, then only of counts. Its territory, which took from it the designation Gapençois, was one of the subdivisions of Haut or Upper Dauphiné. It was bounded on the north by Le Grésivaudan, on the south by Les Baronnies and by the dioceses of Sisteron and Digne, on the east by L'Embrunois, and on the west by Le Diois. [DAUPHINÉ.]

GAR-FISH, a species of fish inhabiting the European seas, and which is caught in tolerable abundance on various parts of the coast of our own country. This fish is allied to the Pike, and from the resemblance it bears to that species, has been called by some the *Sea Pike*. It is however of a more elongated form, and is remarkable for the great length and slenderness of the jaw-bones.

Both jaws are furnished along their edges with numerous small pointed teeth: the upper-jaw, which consists of the intermaxillary bones, is the shorter. The body is covered with scales, which are not very distinct. The dorsal and anal fins are of a simple form, and about equal in size: they are placed opposite each other, and not very distant from the tail, which is forked. The ventral fins are small, and situated behind the middle portion of the body. The upper parts of the head and back are of a deep blue-green colour, and the under parts are silvery-white: the dorsal fin and the tail are greenish-brown; the other fins are white. The ordinary length of this fish is about two feet.

The *gar-fish* is sold in the London and other markets; its flesh somewhat resembles that of the mackerel in flavour, but is more dry; before it is cooked it emits an unpleasant odour; the bones are green. 'The elongated narrow beak-like mandibles of this fish make a knowledge of its food a subject of some interest; but I have only found,' says Mr. Yarrell, 'a thick mucus in the stomach, without any remains that I could name. In all the works to which I have access I can find no mention of the nature of its food.'

In addition to the various parts of our coast, enumerated by Mr. Yarrell, in which the gar-fish is caught, the mouth of the river Mersey may be mentioned. From knowing that

the particular spot in which the fishermen find it in the greatest abundance is very plentifully supplied with sand-worms (*Arenicola piscatorum*), it has occurred to us that they might constitute its principal food. The beak-like jaws are well adapted to seizing such prey.

The gar-fish was included by the older writers in the genus Esox, and is the Esox Belone of Linnæus. It is now however classed in a separate genus, to which Cuvier applied the name of *Belone*, taking the old specific name for the genus, and giving that of *vulgaris* to the species above described.

GARCÃO, PEDRO ANTONIO CORREA, the best lyric poet of Portugal, was born at Lisbon in 1735. After labouring strenuously to correct the bad taste of his countrymen, his somewhat premature death at forty prevented the further success of his talents and exemplary perseverance. His attempt to supersede rhyme by quantity proved however a failure; not indeed from any lack of ingenuity on his part, but owing to the similarity and slight difference between long and short syllables, and the want of a dactylic copiousness which characterize modern languages, in even southern Europe. Garcao's odes, which are clothed in the diction of the sixteenth century, soar above the wearisome sameness of the sonnet and the eclogue of many a distinguished poet. His satires and epistles may be reckoned among the best in modern literature, and are decidedly more Horatian than Ferreira's. His simple drama in iambics, the 'Theatro Novo,' was evidently intended to counteract the passion for the operatic pomp of the Portuguese stage. The 'Assemblea, ou Partida,' another specimen of his plays, in the manner of Terence, is of the same kind as the 'Cecile' of Poinsinet, a satire on the fashionable world; not merely a picture of fashionable manners, as Bouterwek calls it. The 'Obras poeticas de P. A. C. Garcao,' in 8vo., were first published at Lisbon in 1778. (Bouterwek; and Sismondi, *Littérature du Midi de l'Europe*, or its translation by Roscoe.)

GARCILA'SO DE LA VEGA, the intimate friend and associate of Boscan in the radical and successful reformation of Spanish poetry, was born at Toledo, in 1500, or, according to some biographers, in 1503. His family enjoyed great consideration and military reputation; and Garcilaso himself, from the age of eighteen, followed Charles V. over Europe and in his expeditions to Africa till the disastrous retreat of the Imperialists from Marseille in 1536, when, being the first to mount the breach of a tower, which he was ordered to carry by assault, he lost his life in the attempt. He was perhaps the only individual who in that desolating and abortive campaign reaped any glory; at least he transmitted to posterity a more solid reputation acquired by his pen than the restless Charles gained by his policy and the sword. Nothing is recorded of Garcilaso but what is highly honourable to his character and talents, while Spain and Italy are still overwhelmed by the prolific mass of evils which the emperor inflicted on them by his misrule. Despising the clamour raised against introducing into a brave nation the effeminate taste (as his opponents called it) of the conquered Italians, Garcilaso, with equal boldness but greater skill than Boscan, substituted the modern Sapphic or Italian hendecasyllabic verse, both for the short metre of the antient romances and redondillas, and for the heroic Alexandrine and all the verses of *arte mayor*.

The sweetness of many of his thirty-seven sonnets captivates the ear, while the contrast of fear and desire, of sorrow and love, which they express, touches the sympathies of his readers. His odes are still more uniformly excellent; and his last is much praised by Muratori, as his 'Flor de Gnido' is by Paul Jovius and Sir William Jones. But his master-piece is the first of his three eclogues, which has never been equalled by any of the numerous imitations of it. Garcilaso wrote it at Naples under the inspiration of Virgil's tomb, and stimulated by Sanazzaro's reputation. It is to be regretted that in this piece, as in others, his facility and copiousness of expression betrayed him into diffuseness and over-refinement. Nevertheless he is at the head of the pastoral poets of Spain, and he would have been the first of her lyric poets, if he had lived longer, or if Herrera in the following century had not gained that title for himself.

Still Spain will always be indebted to a genius prematurely cut off for the earliest model of purity, elegance, and classical taste in her fine language. Even the severe Quintana, in his strict and lucid 'Essay on Spanish Poetry,' goes so far as to say that Garcilaso drew it suddenly forth from its infancy, and taught it closely to follow the footsteps of the antients and the most celebrated of modern writers; that he gave it wings and gracefulness; that while many words and phrases of his contemporaries have grown obsolete or have totally disappeared, his modes of expression can be used even at the present day. Garcilaso has been printed very often, and commented upon by Herrera, Sancho de las Brozas, Tamaio Vargas, and Azara, the elegant translator of Middleton's 'Life of Cicero,' and finally is now translated into English in a masterly manner by one of our eminent Spanish scholars, the late G. H. Wiffen, librarian to the duke of Bedford.

GARCILA'SO, the Inca, as he styled himself, was born at Cuzco, in Peru, towards the middle of the sixteenth century, after the conquest of that country by the Spaniards. His father Garcilaso de la Vega, allied by blood to the noble houses of Feria and Infantado, served under the Pizarros in that expedition. He married, at Cuzco, Elizabeth Palla of the race of the Incas, who is stated in her son's epitaph at Cordova to have been sister to Huayna Capac, the last emperor of Peru. [ATAHUALLPA.] Young Garcilaso came to Spain at an early age, about 1560; he obtained the rank of captain in the Spanish service, but he seems to have lived the greater part of his life at Cordova, where he died in April, 1616. His contemporary, Father Benaventura de Salinas, in his 'Memorial de la Historia del Nuevo Mundo,' chapter ii., says 'that he was much esteemed by the Catholic kings for the talents he displayed in writing his historical works; that he lived piously, and bequeathed by will his property, which was moderate, to the souls in Purgatory.' He was buried in the cathedral of Cordova, in a chapel which has been called, in consequence, 'Garcilaso's Chapel.' (See the Introduction to Garcilaso's *History of Florida*, Madrid, 1723.) Garcilaso wrote a history of Peru: 'Comentarios Reales que tratan del Origen de los Incas, de sus Leyes y Gobierno,' &c., fol., Lisbon, 1609. Garcilaso's history has been much praised for its impartiality, but its merits have been exaggerated from the supposition that the author, in consequence of his Peruvian connexions, had peculiar sources of information. This however seems not to have been the case. One advantage he had, that of understanding well his maternal language, and he says in his introduction that he was able to correct the misinterpretations of Peruvian words by Spanish writers. His style is reckoned inelegant and diffuse. He wrote an account of the conquest of Florida by Fernando de Soto: 'La Florida del Ynca, Lisbon, 1605. Both Garcilaso's 'History of the Incas' and his 'History of Florida' were translated and published in French, 2 vols. 4to., Amsterdam, 1727.

GARCI'NIA, a genus of the natural family of Guttiferæ, named in honour of Dr. Garcin who travelled in the East Indies. It formerly consisted of few species, but no less than 21 are enumerated by Dr. Wallich, 10 of which he considers new. These are distributed over the islands of the Indian Archipelago, in the southern parts of China, in the Indian and Malayan peninsulas, in Assam and Silhet, with one species (G. Cowa) extending as far north as Monghir on the Ganges. They are all trees of considerable size, with opposite coriaceous shining oval leaves; numerous flowers, which are monœcious or diœcious; in the male, stamens numerous, inserted on a large fleshy 4-lobed receptacle, anthers bursting longitudinally; in the female, stamens numerous but imperfect, ovary 4-10 celled, ovules solitary. The fruit fleshy and juicy, crowned with the peltate stigma, is edible in many of the species.

G. Mangostana is the most remarkable species, being the far-famed Mangosteen (*Mangees*, Marsden) of the Malays, reckoned one of the most delicious of all fruits, and not alone of the countries where it is indigenous, but, as Marsden says, 'is the pride of the Malay Islands and perhaps the most delicate fruit in the world.' It is a native of the Malayan Peninsula and of the Islands to the eastward of the Bay of Bengal, forming trees of considerable size, with a straight trunk and numerous spreading opposite branches forming an elegant conical head. The tree is considered one of the most ornamental in Batavia for gardens, also as affording an agreeable shade. Bontius compares their appearance to that of citron trees. It is in flower and fruit a great part of the year, according to Roxburgh, but Marsden says 'the returns of its seasons are very irregular.' So wedded is it to its indigenous soil and climate, that the innumerable attempts made to cultivate it elsewhere have uniformly

failed. Dr. Roxburgh says, 'For these 35 years past I have laboured in vain to make it grow and be fruitful on the continent of India. The plant has uniformly become sickly when removed to the north or west of the Bay of Bengal, and rarely rises beyond the height of two or three feet before it perishes.' The male and female flowers are sometimes on the same, but usually on separate trees. The germ is superior, round, from 6 to 8-celled, with one ovule in each, attached to the middle of the axis. The ripe berry is spherical, of the size of a pretty large apple, having the surface even, and crowned with the permanent peltate 6 to 8-lobed stigma. The rind is thick, firm, though somewhat spongy, of a dull crimson colour, sometimes compared to that of the pomegranate. Seeds as far as eight in number enclosed in a very abundant soft fleshy envelope which is delicately white, forming the edible part of the fruit, described as delicious to the taste and as dissolving away in the mouth. It is also extremely innocent in its nature, as almost any quantity of it may be eaten without detriment, and persons sick of almost any disease are allowed to partake freely of it without inconvenience. The fruit before ripening is slightly acid. The rind is powerfully astringent, and its decoction is employed in dysentery and as a gargle in aphthæ of the mouth. The bark of the trunk and branches is also considered astringent, and said to be employed by the Chinese in dyeing.

G. Cambogia, Cowa, lanceæfolia, Kydia, pedunculata, and paniculata, all yield a kind of edible fruit, but of these the last is most like the Mangosteen. From incisions made in the branches, a yellow juice exudes and soon concretes, having a close resemblance to, and in fact forming an inferior kind of gamboge; whence it has been inferred that this substance is yielded by a species of this genus, which has therefore been called G. Cambogia. Later investigations have proved the incorrectness of the opinion, and the true gamboge-tree of Ceylon has been determined to belong to a new genus named Hebradendron. [HEBRADENDRON.] G. Cambogia, Zeylona, Cowa, cornea, and pictoria (the last also supposed to be a species of Hebradendron), all yield an inferior kind of gamboge.

Garcinia Cambogia. The species supposed to yield Ceylon gamboge, and indicated as the gamboge-tree in many works. It is distinguished from the other species of Garcinia by its fruit being from 8 to 10-furrowed while that of others is simply round. It is called by the natives of Travancore *Gharka pulli*, and is therefore inferred to be *Carca pulli* of old writers. In Ceylon the fruit is called *Goraka*, and much used by the natives in their curries; when ripe it is said to form a fine fruit as large as the Mangosteen. The tree is one of the most common in the neighbourhood of Colombo, where it attains a large size and forms a handsome tree with thick dark foliage. Mrs. Col. Walker, in her letters to Dr. Graham, describes the outer husk of the fruit as being prepared by the natives by taking out the pulp and seeds, bruising and then heaping it up until the whole is soft. It is then smoked and kept within the influence of smoke, being much used as a favourite ingredient in their curries and also for preserving, along with salt, a small kind of fish, which thus cured will keep for six or seven months.

GARCZYN'SKI, STEPHEN, palatine of Poznania, died in 1755, at an advanced age. He spent all his life in public employments, which gave him the opportunity of acquiring a thorough knowledge of the affairs of his country. He published, in Polish, a political work on Poland, entitled 'The Anatomy of the Republic of Poland,' Warsaw, 1751, and Berlin, 1754.

GARCZYN'SKI, a young man of the same family, who died in 1832, in consequence of the fatigues of the Polish war of 1831, left behind him several poems, which are characterized by great beauties.

GARD, a department in the south of France, which derives its name from the river Gardon, which is found in some compounds (Vers du Gard, Pont du Gard), in the abbreviated form Gard. The department is bounded on the north by that of Ardèche; on the east and south-east by those of Vaucluse and Bouches du Rhône; on the south by the Mediterranean; on the south-west by the department of Hérault; on the west by that of Aveyron; and on the north-west by that of Lozère. The form of the department is irregular; its greatest length is in a direction nearly east and west about 76 miles; its greatest breadth, at right angles to the length, is about 70 miles. The area of the department is about 2294 English square miles, which is rather under the average of the French departments, and rather more than the combined areas of the three English counties of Cambridge, Huntingdon, and Northampton. The population, by the census of 1836, was 366,259, or nearly 160 to a square mile. In absolute and relative population it is below the average of the French departments, and also below the conjoint English counties with which we have compared it. Nîmes, its capital, is in 43° 51′ N. lat., and 4° 21′ E. long., and about 360 miles in a straight line south-by-west of Paris.

Surface: Hydrography; Communications.—The north-western part of the department is occupied by the branches of the Cévennes, of which the principal ridge is for the most part without the boundary of the department. From this part the face of the country gradually declines to the south-east, in which direction the principal rivers flow, to the lower part of the valley of the Rhône and to the Mediterranean. The coast and the lower banks of the Rhône are lined with étangs or pools of considerable size: those of Repausset and Escamandre are among the largest.

The principal rivers are—the Rhône, which bounds the department on the east; the Ardèche, which has the lower part of its course along the northern boundary; the Chassezac, a tributary of the Ardèche, which just touches the northern boundary in one part; the Cèze, about 55 miles long, and its feeders, the Luech, the Auzonet, the Aiguillon, and the Tave. The Gardon, which waters the central districts, falls into the Rhône, and is 65 to 70 miles long: its tributaries are all small. The Vidourle flows into the Etang of Manguio, in the adjacent department of Hérault. Its course may be estimated at from 48 to 50 miles. The Vistre, which flows near Nîmes, and the Rhosny, which flows near Aymargues, unite and serve as feeders to the canal of Radelle. The Hérault, and its tributaries, the Vis and the Rieulor, have their sources and part of their course in the department, as well as the Dourbie, an affluent of the Tarn. Of these rivers only the Rhône and the Ardèche are navigable.

There are several canals. That from the Rhône at Beaucaire to Aiguesmortes (undertaken A.D. 1776, finished A.D. 1812) is about 31 miles long; the canal of Silvéréal, which forms part of the navigation of one arm of the Rhône, is about 7 miles long; that of Bourgidou, from Aiguesmortes to the Canal de Silvéréal, about 6 miles; that of Grau du Roi, nearly 4 miles; and that of Radelle, little more than a mile: making together nearly 50 miles of canal navigation: in all about 111 miles of water communication.

The *Routes Royales*, or government roads, have an aggregate length of above 300 miles, but only about half, according to the official statements last published, are in repair. Of these roads the greater part converge at Nîmes. The *Routes Départementales* ('County Roads,' maintained at the cost of the department) amount to above 400 miles; but not two-fifths are in good repair: the bye-roads and paths (*Chemins vicinaux*) are estimated at 3000 miles. A railroad has been constructed (or is in course of construction) from Alais to Nîmes and Beaucaire: its length is about 43 miles. The above statements are taken from official sources.

Geological Character and Mineral Productions.—The department is chiefly occupied by the oolitic and other strata, which are found between the cretaceous group and the red marl, or new red (or saliferous) sandstone. The south-eastern portion is occupied by the rocks of the supercretaceous group. The primitive rocks which form the loftiest summits, and the western slope of the Cévennes, hardly appear in this department. Its mineral treasures are considerable; but they are either altogether neglected or imperfectly worked. There are mines of antimony, lead (which contains silver), sulphate of lead, oxide of iron, copper, calamine, and manganese, coal-pits, and quarries of gypsum. Ochre, asphaltum, sulphate of magnesia, and clay for porcelain and earthenware, of various degrees of fineness, are procured. There are extensive salt-marshes, the produce of which is considerable, and mineral springs in various places.

Climate.—The air in this department is commonly mild; but in March and April considerable changes of temperature are experienced within the twenty-four hours. In May the heat in the afternoon rises to 77° or even 86° (Fahrenheit); in June to 90° or 93°; and in July and August to 95° or 98°. The autumn is usually dry and cool. The greatest cold is commonly at the end of December.

Soil; Agricultural and other Produce.—The surface of the department is estimated to contain 592,108 hectares, or about 1,463,440 acres: the soil is thus classified:—Rich loam, 11,500 hectares; chalky or limestone, 125,000; gravelly, 15,500; stony, 325,000; sandy, 45,000; various, 70,108: total, 592,108 hectares. The sheltered hills and the plains are devoted to the cultivation of the vine, the olive, the mulberry, and the almond. The arable land is contained chiefly in the valleys. The produce of the department in grain is not sufficient for the home consumption; but what wheat is grown is of superior quality. The soil is thus appropriated:—Arable land, 157,535 hectares; meadows, 8,382; vineyards, 71,306; woods, 106,472; orchards and gardens, 1,592; osier and willow plots, &c., 2,162; various, 58,156; heaths, commons, and other wastes, 158,058; pools, ponds, and ditches, 2,766; lakes, rivers, brooks, 12,365; forests, and non-productive domains, 1,202; not accounted for, 12,112: total, 592,108 hectares. The quantity of arable land sown with different kinds of grain, &c., in 1835 was as follows:—Wheat, 28,953 hectares; rye, 6,286; maslin or mixed corn, 1,681; barley, 5,644; buckwheat, 2,081; maize and millet, 1,181; oats, 7,900; pease, beans, and other pulse, 891; other grain, 442; potatoes, 2,643. The great wealth of the department consists in its wines, and in oil, silk, and delicious fruits.

Only a small number of oxen are reared: but sheep are numerous, and their wool is very fine and much sought after. The horses are small, but vigorous, lively, and allowed to run almost wild. The wolf and the fox are common in the forests, but the wild boar is of rare occurrence: the beaver is occasionally seen in the islands of the Rhône, while the otter has his haunts on the banks of the Gard. Ortolans, red partridges, storks, and bustards are common; and the étangs and rivers abound with fish.

Divisions, Towns, and other Localities.—This department is made up of the former dioceses of Nîmes, and Uzès in Languedoc. It is now divided into four arrondissements as follows:—

Capital.	Population in 1831.	Population in 1836.	Situation, area, and population of arrondts.	sq. miles.	1831.	1836.
Nîmes,	41,266	43,036	S. & S.E.	650	128,461	131,712
Alais,	12,077	13,566	N. & N.W.	528	79,823	83,091
Uzès,	6,162	6,856	E. & N.E.	573	83,752	85,701
Le Vigan,	4,909	5,049	W	543	65,247	65,755
				2294	357,283	366,259

The whole department comprehends 38 cantons and 342 communes.

The towns in the arrondissement of Nîmes, beside the capital, and Beaucaire (population 9967) on the Rhône, of which an account is given elsewhere [Nîmes; Beaucaire], are: Aiguesmortes (pop. 2897), near the sea; Aramon (pop. 2417), on the Rhône; Montfrin (pop. 2331), on the Gard; Marguerittes (pop. 1925) and Milhaud (pop. 1613), on the Vistre; Sommières (pop. 3632), and Villevieille, adjacent to it, on the Vidourle; St. Gilles (pop. 5561), on the canal of Aiguesmortes and Beaucaire; Calvisson (pop. 2692), Aubais, Galargues (pop. 2096), Aymargues (pop. 2182), and St. Laurent, between the Rhosny and the Hérault, and Vauvert, between the Vistre and the Aiguesmortes canal.

Aiguesmortes is well laid out and well built: the houses are chiefly of stone, and of one story only, in order that they may be under the shelter of the ramparts. The inhabitants of the town are engaged in fishing and in procuring salt from the salt-marshes of Peccais, which are a short distance south-east from Aiguesmortes. From May to August 150 workmen are employed in them; but in the latter month more than 2000.

St. Gilles (distinguished as St. Gilles-les-Boucheries) is on an eminence; the kings of the Visigoths had a palace here, and it was the birthplace of Pope Clement IV. The environs produce excellent red wine.

In the arrondissement of Alais, beside the chief town, and Anduze (pop. 5020 town, 5554 commune) [Alais; Anduze], there are Barjac (pop. 1700 town, 1975 commune), between the boundary of the department and the river Cèze; St. Ambroix (pop. 2560 town, 2947 commune), on the Cèze; Genolhac, on a branch of the same river; and St. Jean du Gard (pop. 2788 town, 4128 commune), on the Gardon d'Anduze. At St. Ambroix silk, hats, leather, and nails are manufactured; and at St. Jean du Gard, silk and leather.

In the arrondissement of Uzès, beside the chief town, Uzès, there are Le Pont St. Esprit (pop. 4250 town, 4853 commune); Roquemaure (pop. 2653 town, 4138 commune), and Villeneuve les Avignon (pop. 3564), on the Rhône; Bagnols (pop. 3800 town, 4902 commune), on the Cèze; Laudun (pop. 1888 town, 2260 commune), on the Tave; St. Quentin, near Uzès (pop. 1770 town, 1994 commune); and St. Genies, near the south bank of the Gardon.

Le Pont St. Esprit (Bridge of the Holy Spirit) takes its present name (it was previously called St. Savournin) from a bridge, which at the commencement of the present century was the only one across the Rhône below Lyon, except the bridge of boats established for a part of the year between Beaucaire and Tarascon. Viewed from the river the bridge of St. Esprit presents, from its great length and height, the appearance of a wall built upon arches across the stream Its length is rather more than half a mile; its breadth not more than 14 or 15 feet between the parapets, so that carriages cannot pass each other, except in particular parts widened for the purpose. It has twenty-three arches, nineteen large and four small; beside which the piers have each a small arch above the starlings to admit the passage of the water in the time of the floods. This bridge was built with the offerings presented at a small oratory or chapel on the bank of the river, dedicated to the Holy Spirit; the first stone was laid A.D. 1265. Considering the state of the arts, the breadth and rapidity of the stream, it is a wonderful work. At Le Pont St. Esprit is a citadel built by Louis XIV. to bridle the Protestants of Languedoc. The inhabitants carry on a considerable trade by means of the Rhône, in oil, wine and silk. There is a considerable yearly fair.

The inhabitants of Roquemaure are engaged in silk-weaving and in distilling brandy. There is an old castle, once belonging to the counts of Toulouse. Villeneuve les Avignon forms a suburb of Avignon [Avignon], from which it is separated by the Rhône.

In this arrondissement, on the road from Lyon by Le Pont St. Esprit to Nîmes, is Le Pont du Gard. This aqueduct-bridge, designed to convey the waters of the fountain of Aure to Nîmes, crosses the valley and stream of the Gardon, uniting two steep hills by which the valley is bounded at this place. It consists of two tiers of large arches, and a third tier of small arches which supports the trunk of the aqueduct. The channel for the water is above four feet wide and five deep, and is lined with cement three inches thick, and covered with a fine coat of red clay. The bottom is formed with small stones, gravel, and chalk. The whole work is built of stones joined without mortar or any other cement, except in the trunk for the water. The river, over which the bridge is carried, does not in summer occupy more than one of the arches of the lowest tier; but in the floods in winter its stream is so swelled as to occupy them all.

In the arrondissement of Le Vigan are: Le Vigan, the chief town, on the Arre, a feeder of the Hérault: Valleraugue (pop. 1878 town, 3895 commune), on the Hérault; Sumène (pop. 2030 town, 3017 commune), on the Rieulor; St. André de Valborgne, on the Gardon d'Anduze; La Salle (pop. 1750 town, 2270 commune), on one of the affluents of the Gardon; Aulas, near Le Vigan; and St. Hypolite, or Hippolyte (pop. 5120 town, 5214 commune); Sauve (pop. 2851 town, 3021 commune); and Quissac, on the Vidourle. Le Vigan is amid the Cévennes. The inhabitants are engaged in the manufacture of silk and cotton stockings and leather. St. Hypolite is well built: it is traversed by a canal which supplies several fountains. The inhabitants are engaged in the manufacture of leather, woollen stuffs, and silk and cotton stockings.

The population of the towns, except when mentioned to be otherwise, is from the census of 1831.

In respect of education the department occupies a low place; but it is in advance of the adjacent departments, except that of Hérault. Of the young men enrolled in the military census in 1828-29, only 40 in 100 could read and write. The condition of the mountaineers who occupy the mountains which separate this department from that of Lozère, is very wretched. They dwell in huts built of stone, without windows, and almost without roofs; and a considerable part of their subsistence is derived from the chesnuts, which constitute the only produce of their soil. They are a stunted and ill made race.

This department constitutes the diocese of Nîmes, the bishop of which is a suffragan of the archbishop of Avig

tion. There are many Protestants in the department; they constitute a majority of the population, and have seventeen consistorial churches. The department is within the jurisdiction of the *Cour Royale* of Nîmes, and in the circuit of the *Académie Universitaire* of that city. Among the buildings not subject to taxation, the official returns enumerate 5 prisons, 4 schools, libraries, or establishments for superior education, 24 hospitals or almshouses, and 452 churches and chapels.

The department sends 5 members to the Chamber of Deputies. It is in the ninth military division, of which the head-quarters are at Montpellier.

GARD, PONT DU. [GARD.]

GARDA, THE LAKE OF, the antient Benacus, the largest of the Italian lakes, is in the Lombardo-Venetian kingdom, between the province of Brescia on the west and that of Verona on the east; the boundary between the two provinces crosses the lake in its length. Its south coast belongs to the province of Mantua. The northern extremity of the lake enters the territory of Trent in the Tyrol. Its length, which is north by east to south by west, is 28 Italian miles of 60 to one degree of latitude; and its greatest breadth, which is in its southern part, is 11½ Italian miles; but it is much narrower towards the north. Its greatest depth is about 1800 feet. (Quadri, *Prospetto Statistico delle provincie Venete.*) It receives at its northern extremity the river Sarca, which rises in the mountains of Tyrol, and numerous other streams on its east and west banks. The Mincio issues from its south-east extremity by the fortress of Peschiera. Two ridges of mountains run parallel to its east and west banks; that on the east is more rugged and nearer to the coast, but the western ridge leaves a fine and fertile strip of land between it and the bank, and is known by the name of Riviera di Salò. The south coast of the lake forms part of the great plain of Lombardy. Some account of the territory along the banks of this lake, the scenery of which has been praised by Catullus, Dante, and other poets, is given under the heads BRESCIA and VERONA, THE PROVINCES OF. There is a good description of the lake in Valery's *Voyages Littéraires en Italie.* A steamboat plies on the lake of Garda, between Desenzano on its south coast, and Riva at its north extremity, in the Tyrol. The lake has some small islands near its west coast, the largest of which is called 'Isola Lecchi,' from the name of the family to which it belongs, and is little more than one mile in circumference.

GARDEN. A garden, as distinguished from a farm, is a piece of ground designed for the cultivation of plants not actually indispensable to man for food. While corn for flour, various roots and herbs for the sustenance of cattle, or tracts of pasture land on which animals destined for slaughter are maintained, constitute the essential features of a farm; a garden, even when exclusively occupied by culinary vegetables, is still a source of objects of luxury, not of first necessity; in a more extended sense, and as it usually exists at the present day, it is chiefly intended to gratify the senses and to minister to the more refined enjoyments of social life.

The possession of a garden is one of the most early indications of civilization in man, and it is only among the most brutal and degraded races of savages that it is altogether unknown; while we find such an appendage to a dwelling increased in magnificence, or diminished and neglected, with the prosperity or decline of the most mighty states. It is Lord Bacon who says that 'when ages do grow to civility and elegancy men come to build stately sooner than to garden finely, as if gardening were the greater perfection.'

According to Sir John Malcolm, the Persians had gardens from the period of their first king Mahabad. We learn from Xenophon that Cyrus considered them an indispensable appendage of his residences. 'Wherever he resides, or whatever place he visits in his dominions, he takes care that the *paradises* shall be filled with all that is beautiful and useful which the soil can produce.' (*Cyropæd.* v.) And it appears upon the testimony of Pliny and other Roman authors, that among the same people small gardens existed, in which trees were arranged in straight lines and regular figures, the margins of the walks being planted with tufts of roses, violets, and other odoriferous flowering plants, while the trees consisted of kinds grateful for their fragrance, as the cypress and the pine, or agreeable for their shade, as the plane and the common elm. The Greeks, in their most flourishing times, appear to have been equally attached to the formation of gardens, and even, in some respects, to the nicer parts of the art of gardening. The Oriental narcissus, violet, ivy, and rose, are mentioned as their favourite flowers, and terebinthinous trees as those which were chiefly valued for their fragrance. The rich and polished Athenians are represented by Mr. Meason as having borrowed their gardening from Asia Minor. Myrtles and roses, the box and the lime-tree, were planted for clipping into artificial forms, while flowers and fruits were cultivated in the winter, and the violet was in profusion in the Athenian markets when snow was lying on the ground.

Theophrastus himself not only gives directions for gardening operations, many of which were fanciful enough, such as sowing rue with chips of fig-wood, and pulling up esculents by way of making them more tender, instead of cutting them; but he had a garden of his own which he left to ten of his friends to be preserved as a place of public resort for those who employed their leisure in letters and philosophy. (Diogen. Laert. v. 53.) The instances of the kings Attalus Philometor [ATTALUS] and Mithridates, who cultivated all sorts of poisonous plants in their gardens, are perhaps the earliest upon record of such places being occupied for medical purposes.

It is not to be supposed that gardens were neglected by the luxurious and wealthy Romans. The prodigious gardens of Lucullus, who introduced the cherry, the peach, and the apricot from the Persians, were derided by his Roman friends for their extraordinary sumptuosity. They are related to have consisted of immense artificial towers, large sheets of water, gigantic edifices jutting into the sea, and mountains raised where no hill had existed before. Such an example might be ridiculed by some, but was certain to be followed by others whose taste for splendour and profusion was supported by unbounded wealth; and accordingly the gardens of Sallust, of the emperors Nero and Hadrian, and of many of their subjects, are doubtless to be classed in the same order as those of Lucullus. It is however to be remembered that such gardens were rather more similar to an English park and garden combined than to a mere garden, in the modern sense of the word, and moreover were so uncommon as to be looked upon with wonder by the people among whom they were created. A common Roman garden must have been a very different place, if we are to take the description given by Virgil (*Georgic*, iv. 121) as at all a faithful sketch; for he speaks of nothing but endive (intyba), celery (apium), melons? (cucumis), narcissi, acanthus, roses, ivy, and myrtles. That they had various trees bearing fruit, as well as the common wild timber of the country, and many different kinds of flowers, must of course be admitted; but that all gardens, up to the most flourishing period of the Roman empire, must have been much alike in respect to the plants they contained, is manifest from the fact that hardly more than seventy plants of all descriptions are noticed by this poet, although he wrote professedly upon rural affairs. It is true that the Romans carried their passion for flowers so far that it became necessary to restrain it by sumptuary laws, and that cases of extreme profusion in the use of them are mentioned by historians. The institution of Floralia, or flower-feasts, the universal passion for garlands, the reproaches addressed by Cicero to Verres for having made the tour of Sicily in a litter, seated on roses and decked with festoons of flowers, are a sufficient evidence of this taste having been carried to an extent unknown at the present day; to say nothing of the prodigality of Heliogabalus, or of Cleopatra, the latter of whom is said by Athenæus to have paid upwards of 200*l.* (an Egyptian talent) for roses expended at one supper. But notwithstanding this, the variety of plants that were cultivated in the gardens of both Greeks and Romans must have been extremely small. Theophrastus speaks only of roses, gillyflowers, violets, narcissi, and iris, as used for decoration, to which the larkspur and gladiolus (hyacinthus), with the white lily, and a few others may be added. The great object of their admiration was roses, which were forced by plates of talc (said to have been as much as five feet long; but it is more probable that these *specularia* were sashes five feet long, glazed with talc) being placed over bushes watered with warm water. Pliny, in his 'Natural History,' does not enumerate above one thousand plants of all descriptions, a very small part of which were objects of cul-

tivation. At the fall of the Roman empire the following appear, from Mr. Loudon's statement, to have been the principal garden plants, exclusive of common trees and flowers. 1. *Culinary plants* —peas, beans, vetches, lentils, kidney-beans, gourds, cucumbers, melons, cabbages of many sorts, turnips, carrots, parsnips, beet, skirret, radishes, sorrel, asparagus, onion, garlic, and other alliaceous plants, endive, lettuce, succory, mustard, and other salads, parsley, celery, orach, alexanders, elecampane, fennel, chervil, and some others. 2. *Fruits*:—fig, almond, citron, peach, pomegranate, apricot, plums, and cherries; twenty-two sorts of apples, thirty-six sorts of pears, services, quinces, and medlars; many kind of grapes, mulberries, nuts, walnuts, chesnuts, stone-pines, or pignons, olives, and carobs. They forced flowers with sashes of talc, as has already been noticed, and also cucumbers; it is probable that they extended this practice even to fruits.

With the fall of the Roman empire the art of gardening seems to have been lost, and it was not till a long time after that gardens are again heard of. It was among the monks that the arts of cultivation were preserved, and in connection with monastic institutions gardens again became matter of history. In these religious institutions, which were in many respects the only spots where the arts of peace could find shelter during ages of rapine and violence, gardens continued to be cherished; and although the ignorance of the monks prevented their being rendered so useful as they might have been, yet, on the other hand, their sacred protection opposed an effectual barrier to the wild progress of destruction.

Among his many reformations, the re-establishment of gardens formed part of the policy of the emperor Charlemagne, who introduced the subject into his *capitularies*, commanding gardens to be formed throughout his dominions, and prescribing the very plants which were to be cultivated therein: and considering the state of learning in those days, it must be admitted that the list, short as it is, was prepared with good judgment; for it was made to contain the most useful plants then known for diet or medicine, as well as the favourite ornamental flowers of the Romans. The reader of the present day may be amused at the list of what was thought in the eighth century deserving of an imperial edict, at a time when no one had heard of a garden except within the walls of a castle or a monastery (*Walafridi Strabi Hortulus*):—Roses, Lilies, Fenugreek, Costmary (Costus), Sage, Rue, Southernwood, Melons, Gourds (Cucurbitæ), Water Melons (Pepones), Kidney Beans, Cummin, Rosemary, Caraway, Lentils, Squills (?), Gladiolus, Tarragon, Cucumbers (Coloquintida), Heliotrope, Ammi majus, Sium angustifolium, Lettuce, Nigella sativa, Rocket (Eruca), Nasturtium, Dock, Alexanders, Parsley, Celery, Savin, Fennel, Dittany, Woodmint, Water Mint, Catmint, Centaury, Beet, Marsh Mallows, Carrot, Orach (Adripia), Kohl Rabi, Chives, Radishes, Onions, Madder, Beans, Chervil, Clary, Lovage, Anise, Succory, Mustard, Savory, Mint, Tansy, Poppy, Asarabacca, Hollyhocks, Parsnip, Blite, Cabbage, Leeks, Rocambole, Garlic, Teasel, Peas, Euphorbia Lathyris (Lacteridæ), Houseleek. From this proceeding of Charlemagne the revival of gardens may be said to date, for although there are few direct traces of their existence for some centuries, yet there is no reason whatever to suppose that they were ever again lost sight of. In the fourteenth century we find Matthæus Sylvaticus, a Mantuan physician, speaking of his own garden, and of a Colocasia cultivated in his greenhouse on the edge of a beautiful fountain, and of a plant called Cantalis, supposed to be Athamanta cretensis, which he says he brought out of Greece and planted in his garden. (*Pandect.* c. 197, 133.) It was however in Italy that the formation of gardens received a fresh impulse. Alfonso d'Este, duke of Ferrara, is recorded to have founded several botanic gardens in the 16th century, and especially one called Belvedere surrounded by the water of the Po. The example was followed by several nobles of Ferrara; John Brasavolo, the uncle of the botanist Musa Brasavolo, had a viridarium or greenhouse; another noble, of the name of Acciajuoli, had many rare plants in his garden; and the collections of this city, augmented annually by the commerce of its merchants with Greece and Asia, became so rich in new exotic plants as to become celebrated all over Europe. The Ferrara gardens were soon rivalled by those of the Venetians and Paduans, one of whom, Gaspard de Gabrichis, is said to have spared no expense to enrich his garden, not with costly edifices and vast architectural embellishments, but with plants before unknown. (Spreng. *de R.H.* iv. c. 3.) The greatest and earliest garden however of this æra is generally considered to have been that founded at Pisa, in 1544, by Cosmo de' Medici, on the banks of the Arno; which by the year 1555 had become so rich in plants by the exertions of Lucas Ghini and his successor Cæsalpinus, as to have been the admiration of Belon, no mean judge. Haller indeed is of opinion that a greenhouse built by the bishop of Acquapendente dates from the year 1533, but this is at variance with the statement of Tiraboschi, who fixes the erection in the year 1545. Be this as it may, it is at least certain that about this period a public garden was formed at Bologna, others at Lucca, Naples, and Florence; and that at Verona one Cæsar Niclesola had two large greenhouses in which some very rare plants were preserved. (Pona, *It. Bald.* p. 9.)

At this time Paris possessed no garden for its university; that of Montpellier had however been founded by Henri IV., and contained before the end of the sixteenth century upwards of 1300 French, Alpine, and Pyrenean plants, according to Olivier de Serres (*Traité d'Agricult.*, 1600), and a famous garden had been created at Mans by Renate Bellaye, bishop of that city. In Germany too, the garden of Breslau, to which Tragus and Fuchs were attached, of Basle, Strasburg, and other places, were at this time in existence, and the since celebrated garden at Leyden had been founded in 1577, at the instance of Gerard Bontius.

The principal part of these establishments were founded for academical purposes; when they were formed for private gratification their owners must be considered very much in advance of their times, if we are to form an opinion from the state of private gardening in this country at the same period. Here the only purpose contemplated in the formation of a garden appears to have been an enclosed place in which the owner might walk in seclusion, or in which sport might be had with contrivances like mazes and labyrinths formed of close-cut hedges; a few fruit-trees were added; but no such object as that entertained by the refined Italians, of collecting rare and beautiful plants from foreign countries for pleasure or for scientific purposes, was thought of. In the gardens of Nonesuch, the palace of Henry VIII., executed about the year 1540, we hear of shady walks, columns and pyramids of marble, 'fountains that spout water one round the other like a pyramid, upon which are perched small birds that stream water out of their bills,' and of similar objects, but nothing of the more essential part of a garden—its plants. Pleasure-grounds of this description had existed in England from the time of the Conqueror. Upon this point Mr. Loudon has collected some curious information, but antiquaries have rarely attended to the subject, and a rich field of investigation certainly still remains open to whomsoever is disposed to enter upon it. It is stated by Fitzstephen that in the time of Henry II (1154—1189) the citizens of London had large and beautiful gardens to their villas. In the reign of Edward I. (1272—1307) it may be collected from 'Holinshed's Chronicle,' that the cultivation of the garden was extended to the more curious and delicate productions: but the wars of York and Lancaster destroyed all these occupations, and gardens in general ceased to be more than pleasure-grounds or kitchen-gardens of the rudest kind till the time of Elizabeth. King James I. of Scotland describes the garden at Windsor Castle, where he was confined by Henry V., as a place set thick with trees, and alleys of hawthorn hedges, with an arbour in each corner,—

> 'And myddis every herbore might be sene
> The scharp green swete jenepeie.'—*The Quair.*

Much later (1512) the great Earl of Northumberland, whose household consisted of 160 persons, 'had but one gardener, who attended hourly in the garden for setting of erbis and clipping of knottis, and sweeping the said garden clean.' Nay, it should seem as if sometimes there was not even one; for among the workmen of the household is mentioned the gardener of the place where my lord lyeth, *if there be one.* (Loudon.)

In these remarks all reference is omitted to the gardens of the Arabs; about which almost nothing is known, but which seem to have been more deserving historical record than those of other contemporary nations. That this people in the height of their power paid great attention to botany, is well known to those who are familiar with that science. A learned work on rural affairs was written in the 12th century by Abu Zachariah Ebn Alva, a native of Seville, of

which an epitome has been given by Casirius (*Bibl. Escurial*, i. 326, s.); and according to Mr. Loudon, this writer has left a list of plants cultivated in the garden of Seville, more extensive than that of the Greeks and Romans. In the 13th century the then Vizir of Cairo, Ebn-Beitar, a native of Malaga, was so much attached to botany that he visited all parts of the East for the express purpose of extending his knowledge of plants. His works are preserved in MSS. in the library of the Escurial, and it is said that although he scrupulously abstained from describing anything which he had not seen, yet he speaks of 2000 species more than Dioscorides. (Spreng. i. 238.) It is only reasonable to suppose that such a man had a garden. We must however fix the period when gardens first began to be extensively improved, in the middle of the 16th century, when, as has been already shown, the rich Italians turned their attention to the introduction of new and rare plants. By the time that this new taste began to be fixed in the minds of Europeans, the numerous geographical discoveries that had been made by the Portuguese and Spaniards, had opened new and unheard-of sources from which the lovers of gardens were able to enrich them. It would appear that the maize, the yam, tobacco, and the cotton-tree (Bombax) were brought to Europe by the Spaniards so early as the end of the 15th century (Barcia, *Hist.*, i. 24), and king Ferdinand is recorded to have preferred the pine-apple, brought home in Columbus's second voyage, to all other fruits. (Petr. Martyr. *Reb. Oc. Dec.* l. 2, b. 39.)

It would be impossible to trace the progress of public taste in the construction of gardens any farther historically, without occupying more space than such a subject can have allotted to it in a work of this description. It may easily be conceived that from the time when the taste for gardens revived, up to the present period, there has been a gradual improvement in such places, commensurate with the wealth of individuals and the commercial power of nations, their peaceful habits, the security of property, and their general progress in settling the relations of social life. At the present day the most prosperous nation is Great Britain, and here the cultivation of gardens is unrivalled as a general national object: the most degraded are Spain and Portugal, and there a feeling for garden enjoyment is almost extinct. In the remainder of this article we shall offer a few remarks upon the most important causes which have contributed to bring gardens to their present improved condition, and conclude by a brief account of some of the most remarkable Botanical Gardens of the present day.

The first great step that was made by gardeners to advance their art beyond mere mechanical operations, was the invention of glasshouses, in which plants might be grown in an artificial climate, and protected from the inclemency of weather. Until this was effected, it is obvious that the cultivation of exotic plants in Europe, especially its northern kingdoms, must have been much circumscribed. Mr. Loudon refers the invention of greenhouses to Solomon de Caus, architect and engineer to the Elector Palatine, and who constructed the gardens at Heidelberg in 1619. But there can be no doubt that buildings of this description claim a higher antiquity. The specularia of the Romans, whether pieces of talc 5 feet long, or, as we rather suppose, sashes 5 feet long glazed with talc, were certainly used for the purpose of forcing roses and some other plants; they were essentially greenhouses, although perhaps more like our garden-frames. It is scarcely likely that where gardening survived, the learned men, in whose hands all such subject then were, should have been unacquainted with the existence of these specularia, and they would naturally endeavour to reconstruct them. Greenhouses certainly existed among the Italians in the middle of the 16th century, as has been already mentioned, and there is no reason to suppose they had then for the first time been thought of. In fact, the antient viridarium seems to have been a room with one side of it glazed with sashes reaching from the top to the bottom, and resembling the old English conservatory. It may or may not have been heated; probably not, for it was chiefly Greek, Egyptian, and Levant plants that were at first cultivated as rarities by the wealthy Italians, and they required no artificial heat in Italy.

If heat was required, it would be supplied by stoves or such other contrivances as were used for domestic purposes. Ray says, that in 1684 the greenhouse in the Apothecaries' garden at Chelsea was heated by means of embers placed in a hole in the floor; and it appears, from a section of a greenhouse in the Electoral garden at Manheim, published in 'Medicus Index Plantarum,' that a German stove was used there as late as 1771. We however agree with Mr. Loudon in considering the invention of *glass-roofs* for greenhouses to be an æra from which the principal part of modern improvements takes its date. This happened in 1717, when Switzer published the plan of a forcing-house, suggested by the Duke of Rutland's graperies at Belvoir Castle. Up to that time the want of light must have rendered it impossible to employ greenhouses for the growth of plants, either in winter or summer; they could only have been hybernatories, receptacles in which plants might be protected from wet or cold during winter, but from which they were transferred to the open air as soon as the spring became sufficiently mild. The substitution of glass-roofs, by increasing the quantity of light, put it at once in the power of the gardener to cultivate permanently in his greenhouse those natives of hot countries which are not capable of bearing the open air of Europe even during the summer. From the time of Switzer to the present day there has been a gradual improvement in the construction of greenhouses, the object being to supply the plants with as nearly the same amount of light when under the glass-roof, as they would have had if in the open air. The modern invention of curvilinear iron-roofs has accomplished this end in a most remarkable degree: for they substitute an obstruction to light amounting to only $\frac{1}{23}$ or $\frac{1}{27}$ for a loss equivalent to $\frac{1}{4}$ or even $_{"}$

The mode of heating such houses has given the modern cultivator additional advantages of the greatest importance. Stoves of all kinds not only dry up the moisture of the atmosphere, but impregnate the air with gaseous exhalations unfavourable to vegetation. The substitution of flues, whil it equalized the heat, was still worse than the stove in drying and deteriorating the air; the introduction of fermenting vegetable matter, such as tan in a pit, in the interior of the house, remedied this evil in some measure, but the application of steam-pipes or hot-water pipes has had the great advantage of obviating every inconvenience, and has given the gardener the power of modifying the heat and moisture of his greenhouse at pleasure. Add to this, the rapidity of communication between one country and another, the long peace with which Europe has been blessed, and the leisure it has given men to occupy themselves with domestic enjoyments, the great encouragement given to gardeners, the establishment of Horticultural Societies for the promotion of the art of gardening, and the discoveries made in vegetable physiology—add all these things to the improvements in greenhouses, under which name is here included all descriptions of glass buildings for horticultural purposes, and there is no difficulty in accounting for the present flourishing condition of European gardens.

There is one point further that requires to be noticed, as contributing to this result, and that is, the extension of the education of the working gardener. Great numbers of gardeners are now well informed in the higher branches of their profession. Instead of trusting to certain empirical rules, or to *receipts* for gardening operations, as if growing a plant was much the same thing as making a pudding, they make themselves acquainted with the principles upon which their operations are conducted, they acquire a knowledge of botany and vegetable physiology, and some even of physical geography, and thus they place themselves in the only position from which they can securely advance to the improvement of their art. The necessity of these subjects forming a part of all gardeners' education cannot be too strongly insisted upon; the Horticultural Society of London have recognised their importance by requiring all the young men in their garden to pass an examination in such subjects, in addition to their possessing the usual gardeners' acquirements; and although people ignorant of such subjects themselves have been found absurd enough to blame the proceeding, there can be no doubt that the world will give the Society the credit they deserve for having been the first to set this most important example, which we trust will be followed by all such institutions through the country.

In noticing modern gardens we must necessarily confine ourselves to a few of the most remarkable, passing by entirely those of private individuals, and in general all second-rate public establishments. The reader who is desirous of procuring detailed information upon the subject will find an ample account of all the best modern gardens in Mr. Loudon's ex-

cellent *Encyclopedia of Gardening*, edition of 1835, to which we have been much indebted for this article.

Although the restoration of gardens took place among the nobles of Italy, and many noble instances of wealth and taste applied to such purposes still remain, yet the political condition of that country is unfavourable to horticultural pursuits, and although there are gardens attached to most of the Italian cities, there are none of much note, except for their picturesque features and fine architectural embellishments. Those of Naples, Florence, and Monza near Milan, are the most remarkable, especially the last. This is described as seated in a park of 3000 acres, with a gently varied fertile surface. It is well watered; 'the culinary, flower, botanic, and fruit gardens, orangeries and hothouses, are all good, and as well managed as the circumstances of the present vice-king will permit.' The river Lambro passes through the grounds. There is a double avenue leading to Milan planted with tulip-trees, magnolias, melias, robinias, and other flowering trees, interspersed with evergreens and American oaks, the whole having a very beautiful effect. Among other things there is in this garden a shrubbery composed entirely of Magnolia grandiflora, some specimens of which have attained a great height. The botanic garden contains a numerous collection of plants from all parts of the world. The hothouses are numerous, and shelter an immense number of orange and lemon trees, as well as other plants of ornament. Pine-apples are also grown with some success.

The Dutch, although too much attached to the stiff formal style of clipped hedges, straight walks, and architectural puerilities, have always had a great reputation as gardeners. Their wealth and their commerce with the Cape of Good Hope and the East Indies gave them for a while extraordinary advantages over other nations, and for a long time their garden of Leyden was considered the richest in Europe. It was begun in 1577; in 1633 it contained 1104 species, and was so rapidly enriched by the zeal of the wealthy Dutch merchants, that in 1720 no fewer than 6000 species were catalogued by Boerhaave, who was then professor of botany at Leyden. From this source was at one time obtained the principal part of the succulent and other plants native of the Cape of Good Hope. It was afterwards a good deal neglected, but is now renovated under the care of Dr. Blume. It was thus spoken of by the author of a 'Tour through South Holland,' who visited it in 1830:—'It does credit to all who belong to it, being kept in the highest possible order. Its walks are beautiful, and without a pebble; they are covered with a mixture of peat earth and the spent dust of tanners' oak bark. The garden is tastefully laid out in clumps of shrubbery in various forms, round which, on borders, are the various plants, named and numbered according to the system of Jussieu. The whole extent is seven acres; four of which have been added only a few years ago, and laid out in good taste by the late professor Brugmans, as a garden for the reception of medicinal plants, and for the use of the medical students. Among the hothouse plants we saw a date-palm with fruit upon it, which tree the gardener said had been there 200 years. It may be questioned whether the botanic garden at Leyden and its museum are not superior to the Jardin des Plantes and its museum in Paris. Taken altogether, we are of opinion that they had a decided preference, though they wanted the attraction of living animals.

In the Netherlands there are small public gardens, both at Antwerp and Ghent, and one of the finest in Europe at Brussels. Some years since it was a wretched place, scarcely deserving the name of a garden; but in 1826 it was removed to its present site on the boulevards, and entirely reformed. It now contains a range of hothouses, 400 feet long, ornamented with a rotunda and porticos, and an extensive collection of plants. The roof of the houses is formed of curvilinear iron bars, and the whole is heated by steam. The principal range is seated on a terrace, with several fountains and broad flights of steps in front of it; while on a lower level are two low ranges of pits for pineapple plants and small tropical species. Opposite to the hothouses are the herbaceous grounds, laid out in a circular manner, and divided into small compartments for the Linnæan classification. (Forbes's *Tour*.) The author from whom this statement is taken complains of the ground being occupied by common forest trees and shrubs, with but little novelty or rarity among them.

Among the German sovereigns a taste for gardening has grown up in a degree unknown in any other country except among the English. A love of the beautiful, a fondness for natural objects, a quiet contented character, so characteristic of the German nations, has no doubt been the cause of this. In Loudon's 'History of Gardening,' no fewer than ninety closely printed pages are occupied with short accounts of the principal gardens of Germany only. Of these we can only select those of Munich, Berlin, and Vienna.

The garden of Munich, under the direction of Dr. Von Martius, is extremely rich in plants that can be cultivated in greenhouses and hothouses, but poor in those species which require to be grown in the open air: this happens in consequence of the severity of the winter, which destroys even the holly. There is a very fine range of hothouses, containing numerous palms, succulent and other plants. It is however considered that the plants in the hothouses at Nymphenburg are much finer than those at Munich; the collection of palms contains larger specimens; but it excites the surprise of the English traveller to find Laurustinuses and Rhododendrons treated as greenhouse plants.

The botanic garden at Berlin has long been one of the great sources from which the gardens of Europe have derived supplies of new plants, chiefly from Brazil, Mexico, and the Cape of Good Hope, in which country the king of Prussia has maintained collectors. It contains many hothouses and greenhouses, each of which is often dedicated to the reception of plants of some one tribe only. There is one for Endogenous plants exclusively, another for ferns and palms, a third for New Holland plants, and others for heaths, Cape, New Holland, and Mexican plants; there are some very fine palms, and in all respects the collection of species is probably the most extensive in the world. Mr. Forbes, the gardener to the duke of Bedford, who visited it in 1837, speaks of it in terms of great admiration. He says he never before saw so many plants cultivated in pots. 'The numerous species of New Holland and Cape genera were quite astonishing, as well as the hardy and Alpine species.' In point of beauty however there is nothing in the garden of Berlin to be compared with the conservatory in the garden of Pfauen-inseln, one of the pleasure-gardens of the king of Prussia. This building is 120 feet long, 40 feet wide, and 42 feet high; it has a span roof, but the north side is of solid brick-work, having a gallery running along it, from which the visiter looks down upon the plants beneath. In this place are some noble palm-trees; Latania borbonica is 27 feet high, Pandanis utilis 23 feet high, a Dragon-tree 36 feet high, and many others of unusual magnificence. The Latania is placed in the middle of the conservatory, having the tub in which it grows concealed by ferns and various low-growing plants.

If the garden of Schönbrunn is less rich in plants than that of Berlin, it much excels it in the magnificence of its hothouses and greenhouses. The emperors of Austria have for above a century been anxious to render this garden the finest in the world; and no cost has been spared in sending gardeners to foreign countries in order to increase the collection. It is however chiefly by supplies from the tropical parts of America that this garden has been enriched. There are several ranges of glasshouses, one 270 feet long and 30 feet high, another 300 feet long and about the same height, and three lower ranges, each about 240 feet long. Nothing can exceed the beauty of the interior of some of these glass palaces, in which the species are grouped with great taste, and which from their size allow the plants to grow with all their native tropical luxuriance.

Rivalling these imperial structures are the gardens of St. Petersburg, founded by the emperor Alexander on the Apothecaries' Island in the Neva. In a country with such a climate as Russia gardening can hardly exist except under glass roofs, and it is necessary to call in aid all the resources of art in order to overcome the difficulties of nature. It is not surprising then that in this situation the glasshouses should exceed in extent those of all other parts of Europe. Altogether there are 3624 feet of such buildings, forming a double parallelogram, the principal sides of which are 700 feet long and from 20 to 30 feet wide. The middle range is 40 feet high in the centre. All this vast extent of glass is heated by common flues. In the open ground there is a large collection of hardy plants, a quarter devoted to systematical botany for the purposes of students, an arboretum, and a division for medicinal species. One excellent feature in the internal arrangements of this garden is the

placing the plants geographically, so that the most careless observer in proceeding through the different suites cannot fail to be struck with the changes in vegetation as he passes from Africa to America, to New Holland, to India, China, and so on.

In France gardening has never been in a very flourishing condition; it is true that great quantities of vegetables are raised for the market, that the fruits of France are justly celebrated for their excellence, and the flower-markets of Paris are well supplied; it is also true that numerous excellent works on gardening have been written in France. But for the quality of their fruit the French are chiefly indebted to their climate, for the abundant supply of the vegetable market to their peculiar cookery, and for the excellence of their written works rather to the ingenuity of a few clever men, than to the general habits of the community. In flowers their taste is rather that of the Romans than of other European nations, for they are contented with a few showy kinds of sweet-smelling flowers, especially roses. Their great public gardens remind one of the days of Henry VIII., and if it were not for the imposing effect produced by the architectural grandeur of the buildings with which they are associated, they would be quite contemptible as works of the nineteenth century. There no doubt are exceptions to this statement, but as a general fact it cannot be contradicted. The Garden of Plants at Paris, which is the largest of the public establishments in France to which the name of garden properly applies, is not an exception to this statement, so far as the plants it contains are concerned. In 1818 it consisted, in the open air, of departments devoted to various purposes of teaching; there was an indifferent collection of hardy herbaceous plants, and hardy trees and shrubs, some puerile contrivances to aid the student of agriculture: the plants in the houses were ill cultivated, few in number for such a place, and altogether unworthy of the reputation the garden had gained. Since that period two large hothouses have been built, 72 feet long, 42 feet wide, and about 50 feet high, with iron span roofs and heated by steam, and undoubtedly the establishment is progressing to a better state. But even now there are few judges of gardens who would assign the Jardin des Plantes a place among the first class of European gardens.

In Great Britain it has never been the policy of the government to offer direct encouragement to either science or art, except in an uncertain and sparing manner, but rather to throw the duty of fostering them upon the people. So far as gardening is concerned the government has been right; for if in this country such public gardens as we have enumerated are unknown; on the other hand no part of the Continent possesses such multitudes of good private gardens as Great Britain. That which in other countries is a luxury, provided for at the public expense, is here rendered a kind of necessity, which all persons, from the cottager to the noble, strive to possess. Nothing can be more beneficial to the community, or more advantageous to horticulture itself, than this difference, for the result is not here and there a magnificent garden, and all round it comparative sterility, but a universal garden all over the country. The chief English garden containing a large collection of plants is that of Kew, which is certainly the richest in the world in New Holland plants, and which was, during the late war, almost the only place in Europe to which exotic plants were introduced in considerable quantity. It contains a bad and ill-named or rather unnamed collection of hardy plants, and a good many small hothouses and greenhouses filled with rare plants; there is moreover an excellent kitchen-garden and forcing department. In consequence of this establishment having had a monopoly of government support for above 30 years, it has been the channel through which an enormous quantity of new plants have been introduced to Europe from all parts of the world. For many years however it was unworthy of the nation, from the illiberal manner in which it was conducted, a system of exclusive possession having been observed in it, which was most disgraceful to those by whose authority it was maintained, and who acted as if such gardens were supplied by the public purse for the private gratification of a few selfish courtiers, and not for either the crown or the country. Of late years however this system has been abandoned, a liberal management has been introduced, and the collection is as accessible as that of other nations. Next in importance among public gardens is that of the Horticultural Society, at Chiswick, near London. It was established at the expense of the members of the society, and was intended both as a place of experimental researches in horticultural science, and as a station whence the most valuable, useful, and ornamental plants of all kinds, might be distributed through the country; for which purposes its extent, amounting to 33 acres, was expected to be amply sufficient. It has now been instituted 17 years, and consists of—1, an Arboretum, probably the richest in Europe in trees and shrubs that are ornamental; 2, of an orchard, beyond all comparison the most perfect collection of fruit-trees, of all descriptions, that has ever been formed; 3, of a few forcing-houses, now chiefly employed in the determination of the quality of different kinds of grapes; 4, of a kitchen-garden, in which trials are made of new vegetables, or of new methods of cultivation; but which is principally used as a school of practice for the improvement of the young gardeners in this branch of their art; and 5, of a few small hothouses and greenhouses filled with rare plants. It is moreover conducted as a kind of normal school for young men intended for gardeners, who are now obliged to pass an examination in the principles of their business before they are recommended to places. It was originally intended to erect a magnificent range of hothouses, but the mismanagement of the funds of the society by the late secretary has prevented that object being yet accomplished; it is however generally understood that this part of the plan, so far from being abandoned, will actually be commenced in a few months, now that the resources of the corporation have been invigorated by a more prudent and careful management. Even as it is, no association of individuals ever produced so marked an effect upon gardening in a few years as has been brought about by the enormous distributions of cuttings of improved fruit-trees, of the finest kinds of vegetable seeds, and of new plants mostly imported direct from the British colonies and from the west coast of America, made annually from the society's gardens, independently of the collections sent in return to all parts of the world.

The botanic garden of Edinburgh is one of the finest and best-managed in Europe. It consists of 16 acres, delightfully situated, and includes everything that can be required for the purposes of teaching. The houses are remarkably good, and the healthy condition of the plants deserving of all praise. It is particularly celebrated for its beautiful specimens of heaths. Besides these, there are botanic gardens at Glasgow, Liverpool, Cambridge, and Oxford; fine public gardens in the towns of Sheffield, Manchester, and Birmingham; and a garden at Chelsea, belonging to the Apothecaries' Company, who maintain it for the use of the medical students of the London schools. The latter was once among the most celebrated in Europe, having been for nearly 50 years under the management of Philip Miller, the author of the 'Gardener's Dictionary,' and whom Linnæus called the 'prince of gardeners.' Its situation has however become unfavourable for a garden, in consequence of the number of houses with which it is surrounded; and the collection had latterly fallen into some disorder; but a commencement has lately been made by the present professor to re-arrange it, and it may again be expected to become an efficient school of botanical instruction.

The number of species included in Loudon's 'Hortus Britannicus,' or catalogue of the plants either cultivated in Great Britain or indigenous, amounted in 1830 to upwards of 25,000, exclusive of Cryptogamous plants; and although a vast number of deductions must be made, it is not improbable that there are at this time nearly as many species known in the different British collections.

GARDEN HUSBANDRY is a branch of Horticulture, the object of which is to raise fruits, vegetables, and seeds for profit on a smaller extent of ground than is usually occupied for the purpose of Agriculture.

The best examples of this kind of industry are found among the market-gardeners near populous towns, particularly London, Paris, and Amsterdam. By the application of much manual labour and an abundant supply of manure they accelerate the growth of vegetables, and produce them more abundantly than where manure is not so easily obtained, or where there is not so large a demand for the produce.

The gardeners near Paris, some of whom have gardens within the outer walls of the city, are called *Maraichers*, from the situation of their gardens in a low district which

was formerly a marsh (*marais*). The industry of this laborious class is proverbial. Their whole life is devoted to their gardens. They work the whole day in the greatest heat of the sun, and long before the rest of the inhabitants awake they are on their way to the market with their produce. The soil in which they raise their vegetables is naturally a poor sand, but by constant manuring it has been converted into a very rich mould abounding in humus. From its porous nature, and the frequent recurrence of dry summers, it would produce little without constant and abundant watering. The raising of water from numerous wells dispersed through the grounds, and conveying it to the growing plants, is the most laborious part of the work: during the whole summer this labour is incessant. There are large stone cisterns in which the water is allowed to remain that it may acquire the temperature of the air; and from these it is carried by pipes into various channels which intersect the garden in every direction. These gardeners divide the season into three periods. The first begins in October, when they sow lettuces in a hot-bed, which are pricked out a month after, and planted finally in a sheltered border about the end of January, the ground having been well dug and abundantly manured with very rotten dung taken from the hotbeds. At the same time they sow radishes and leeks among the lettuces. The radishes are sold by the end of March, the lettuces in May, and the leeks in June. This completes the first season. The ground is now dug again, and manured with fresh long stable dung mixed with the earth of which the hotbeds were formed; in this they plant alternate rows of endive or scarolles (both varieties of chicory), and of cucumbers, which produce gurkens for pickling and sauces. The endive is sold in July, and the small cucumbers continue to be gathered till September. In the third season, which is the shortest, another digging and dunging is given, after which they sow radishes and small winter-salad, of which the French have a great variety. Winter endive is also planted for blanching. From this statement it appears that the ground produces a constant succession of culinary vegetables, and that it is manured thrice in the year. The great object is to have a rapid succession, and to allow no plant to occupy the ground long. Cabbages, cauliflowers, asparagus, artichokes, and other vegetables which remain a long time on the ground, are cultivated at a greater distance from Paris, where the land lets at a lower rate. These plants will bear to be carried to a greater distance than the delicate vegetables which are used chiefly in a raw state as salads. The only perennial plant in the gardens of the Maraichers is sorrel, of which there is a great consumption. This is continually dunged and watered to accelerate its growth, and is cut many times in the season. It must however be allowed that this forcing with manure and water, although it produces large and delicate fibres, does not give the flavour which belongs to vegetables grown in common earth, and which have had a more natural growth.

The market-gardens near London are on a larger scale, and if they produce fewer salads and pot-herbs, they produce better and more substantial vegetables, and likewise a considerable quantity of fruit. Mr. Middleton in his 'View of the Agriculture of Middlesex,' (London, 1813), gives an account of the management and produce of the gardens near London, which chiefly supply Covent Garden market.

The best soil is a moist alluvial loam deposited from repeated overflowings of the Thames, which are now prevented by banks or dykes. But an increased demand for vegetables has caused much inferior soils to be cultivated as gardens, and increased labour and manure have supplied the deficiency in natural fertility. The gardeners' year properly begins in autumn, when the land is dug, or rather trenched, and well manured. Various vegetables, which will be required in winter, are now sown, and especially those which are to produce plants to be set out in spring: spinach, onions, radishes, and winter salads are sown, and when the weather is severe, are protected by a slight covering of straw or mats. In February, the cauliflowers which have been raised in frames or under hand-glasses are planted out. The cabbage plants are pricked out. The radishes, onions, and salads go to market as soon as they are of sufficient size, and sugar-loaf cabbages succeed them. As the cauliflowers are taken off, they are succeeded by endive and celery, and the same is the case with the cabbages. Thus there is a constant succession of vegetables, without one moment's respite to the ground, which, in consequence of continual stirring and manuring, maintains its productive power. Deep trenching in some degree prevents that peculiar deterioration of the soil which would be the consequence of the frequent repetition of similar plants. This effect is most perceptible when the plants perfect their seed, which is seldom or never allowed to take place in market-gardens; but great attention is paid to the species of plants which succeed each other on the same spot. The principle which experience and theory unite in establishing, is that of avoiding the too frequent recurrence of plants which belong to the same natural families. The greater variety cultivated in gardens, in comparison with the common produce on a farm, enables this principle to be fully acted upon. Those gardeners who overlook this, and repeatedly sow or plant the same kind of vegetables in the same spots, are soon aware of their error by the diminution of the produce, both in quantity and quality, and by various diseases which attack the plants, however abundant may be the food supplied to them, or careful the tillage.

The principle on which the gardens are cultivated, is that of forcing vegetation by means of an abundant supply of dung, constant tillage, and occasional watering. The whole surface is converted into a species of hotbed; and crop succeeds crop with a rapidity which is truly astonishing. Those vegetables which arrive at a marketable state in the least time are always the most profitable, and those also for which there is a constant demand at all times of the year. With an abundant supply of manure, the market-gardeners have no fear of exhausting the soil; and dissimilar vegetables may grow together on the same ground. Trees bearing fruit may be planted in rows, especially those of the dwarf kind; and under them those vegetables which do not require much sun may be raised to advantage. This is a very common arrangement in the market gardens near London. Raspberries, gooseberries, and currants, are planted in the rows between the trees. These rows being thirty or forty feet apart, leave ample room for vegetables. But in those gardens where the finest vegetables are raised, and particularly in those which are appropriated to the growth of seeds, no trees are permitted to shade the ground: even the hedges, if there are any, are kept low and clipped, that they may not give any shade, or harbour small birds. The market-gardeners near London do not raise many peas or beans, except such as are forced and require glass frames to protect them. The chief supply of peas in the season comes from a greater distance, and is the produce of whole fields sown for that purpose by the farmers within a moderate distance of London. This crop would not be so profitable in a confined garden cultivated at a great expense.

The value of the produce in one year, from an acre of garden-ground in the most favourable situation, as stated by Mr. Middleton, from the account which he received from a market-gardener, is almost incredible. It is as follows:—radishes, 10*l.*; cauliflower, 60*l.*; cabbages, 30*l.*; celery (first crop), 50*l.*; (second crop), 40*l.*; endive, 30*l.*: making a total of 220*l.* for the gross produce of an acre in twelve months. The expenses of cultivation are very great. In inferior situations, the produce is much less, but the expenses are also somewhat less. When it is considered that there are nearly 2000 acres thus cultivated, the gross amount of produce must be very great.

A garden should always be laid out in a regular form, with narrow parallel beds, and paths between them. One or more roads, of sufficient width to allow a cart to pass, should intersect these beds at right angles, for the convenience of bringing manure and taking off the produce. The beds should not be above six feet wide; so that a person may easily pull up weeds, or gather the vegetables without treading upon the beds. The surface-soil taken from the paths serves to raise the beds, and in retentive soils may carry off the superfluous water after sudden and violent rains. The whole ground should have been trenched two spits deep or more; and this trenching should be frequently repeated, to mix the upper with the under part of the soil, and distribute the decomposed dung throughout the whole depth. Thus in time a rich black mould will be produced, in which every kind of vegetable will grow most rapidly. For early plants, and those which are used in winter, and require to be protected from frost, narrow beds are made lying in a direction east and west, and sloping towards the south, with the north side raised high, so that their surface forms an angle of twenty or thirty degrees with the horizon. This gives the plants a protection from the north winds, and

exposes them more to the influence of the sun. In very frosty weather, these beds are covered with mats or loose straw. We do not mention frames covered with glass, as they belong to a higher kind of horticulture: but a moderate hotbed made with fresh dung, and covered with mats laid over hoops, is indispensable for the raising of early vegetables. By these means radishes and various salads may be raised very early in the spring, and sometimes, in mild winters, without any interruption during the whole year.

An abundant supply of manure is indispensable in a market-garden, and this can generally be obtained in large towns at a trifling expense. The neighbourhood of a town is therefore a necessary circumstance towards the production of the crop, as well as its sale. It would be impossible to make a sufficient quantity of manure by means of the horses which are employed to carry the produce to market; and the extent of land usually laid out in garden-ground could not raise sufficient food for cattle, without taking up a space which may be more profitably employed. The only animal which can be kept to advantage by a gardener is a pig. This animal will live well on the offal of vegetables; and the gardens of cottagers could not well be kept in a fertile state if it were not for the manure made by the pigs.

The market-gardeners about Amsterdam are mostly Jews, and the vegetables which they bring to market are similar to those of the London or Paris gardeners; but they excel particularly in raising cauliflowers, large white cabbages for making *saur-kraut*, a dish much relished in the winter by the Dutch and Germans, [Cabbage,] French beans, cucumbers, and melons. They raise these last in such abundance, that heaps of them are sold in the markets at a very low rate. They also excel in the forcing of early peas and beans, and in the general management of hot beds.

The profits of a garden near London, of the extent of ten or twelve acres, are as great as that of a farm of ten times the extent cultivated in the best manner, without the help of purchased manure. But if manure can be obtained at a reasonable rate, as is often the case in great thoroughfares, where many horses are kept for public conveyances, although there be no immediate demand for vegetables, a garden may be very profitably cultivated, entirely for the purpose of raising seeds. This branch of industry is the more worthy of notice, as it may enable a cottager to improve his situation greatly by the produce of a small garden or allotment of land. The demand for seeds of all the most common productions of a garden, and especially of flowers, is great beyond belief, and the profit of those who retail them in small quantities is so great that they can afford a liberal price to those who raise them with proper care so as to keep the varieties distinct.

In some agricultural districts it is the custom for the labourers to plant turnips in their gardens in November, in order to obtain the seed in time for sowing in the next year. They choose the soundest and best shaped, and by attention in keeping the ground clean, and allowing only one sort to go to seed within a certain distance, they produce a better seed than the farmer could; because the labourer and his family having their garden constantly in view, can more easily keep off birds and watch the ripening of the seed, so as to allow it to come to perfect maturity, without danger of the pods bursting, and shedding the seed from being left too long. Thus they can collect a bushel or two of excellent seed from a small portion of land; and this, at the price of a guinea a bushel, which is cheaper to the farmer than if he raised it himself, or purchased it of the seedsman, is a very profitable crop to the labourer. An industrious cottager, without losing any time, with the help of his wife and children, may much increase his comforts in this manner, while at the same time he trains his children in habits of industry. To no class of men would a knowledge of garden husbandry be more useful. The improvement which may be made in the condition and character of the poor, by combining in their education a knowledge of the most common arts of life with that of letters, which is often the only thing taught in schools, must be evident to every man who has reflected on the subject; and of all these arts the most generally useful amongst an agricultural population is the art of horticulture. The cottager who is acquainted with the means of raising early garden produce, who can graft young trees, who knows what plants may be propagated with a little care, and be readily sold when in perfection, can employ his labour with a double advantage. And many a man, from a very small beginning, has, with a moderate share of judgment and prudence, raised himself to independence, if not to affluence; while he that plods on in the beaten track like a horse in a mill ends his days in ignorance and poverty.

The great superiority of those schools which have been established to teach the children of the poor to work as well as to read, over those which teach book knowledge only, is indisputable. A boy who can manage a little garden, who takes a pleasure in watching the seed he has sown, who plucks out every weed as soon as it appears, and who prides himself on the fruit and vegetables which he can place on his father's table, is more advanced in his education than he who can only read and write, however well he may do both.

Many plans have been proposed for the distribution of the crops in a cottage garden; but none of them are suited to every situation. Much depends on the nature of the soil, which may be better suited to one kind of produce than another; and also to the demand for any peculiar class of vegetables. New sorts may often be introduced with advantage. The raising of any useful plant with great care will often give a man a reputation, which makes it advantageous to him to confine himself to these principally, and raise them in the greatest perfection. An ingenious man will find out what is most for his own advantage; and from the list of plants which may be cultivated for ornament or for use a selection may be made which may be well suited to the situation of the ground and the circumstances of the grower. The practice of the market-gardeners may be examined with advantage; and long experience, with the test of profit, will lay down better practical rules than the most plausible theories.

An allotment of land such as is now very frequently given to agricultural labourers with the laudable intention of making them more industrious and independent of parochial relief, may be cultivated to great advantage by applying judiciously the general principles of garden husbandry. There are few cottages which have not already attached to them a small garden of a few perches, in which common vegetables, such as cabbages, onions, and early potatoes, are raised. The same vegetables may continue to be cultivated there, provided the situation is more convenient from its proximity to the cottage, or a small part of the allotment may be set apart every year for this purpose, so as to change the crops, which is always an advantage. But the remainder of the allotment should be cultivated on a regular plan, as a farm in miniature, with this difference, that all the operations should be performed with the minute attention of a gardener. Potatoes and wheat, if the soil is not too light for the latter, or rye, in very sandy soils, will be the principal crops, being immediately necessary to the support of the family. These crops have sometimes been recommended to be raised in every alternate year; but whatever be the tillage or manuring, there are few soils which will not soon be reduced in fertility by this constant succession. One-fourth of the land in wheat, and one-fourth in potatoes, is the utmost which can be profitably cultivated in one year. The remaining half of the allotment must produce pulse, roots, and green crops, by which animals may be fed and manure collected. An allotment of three acres will enable a cottager to keep a cow, by having a portion of it in clover or other artificial grass. In the 'Farmer's Magazine' for February, 1802 (p. 38), there is an article drawn up by Mr. John Sinclair, in which it is shown how this may be effected without difficulty. But as the allotments usually given to labourers seldom exceed half an acre, or at the most an acre, the keeping of a cow is out of the question; and the only animal which can be profitably reared and fatted is the pig, to which we shall therefore confine our observations. By means of pigs the cottager may greatly increase the profit which can be made from his allotment of land, keeping up at the same time a proper degree of fertility. One-half of his land must be cultivated to feed his pigs; besides the smaller potatoes which remain when the finest and best are taken out for the use of the family, he may give them beans, barley, carrots, parsnips, and turnips, especially the Roota Baga, or Swedish turnip; and all the straw must be used for litter. If this be strictly attended to, the greatest possible profit will be made from the land, without any danger of its being exhausted and loosing its fertility. The rotations will therefore be—potatoes, with a great quantity of manure; then barley, then peas, beans, carrots, parsnips, and Swedish turnips,

manured; and after these wheat. The application of the garden husbandry must be in the preparation of the soil by deep trenching and digging, carefully drilling or dibbling all the seeds in rows, stirring the soil between the growing plants, and keeping the ground clear of weeds by the hand and the hoe. These last are the most essential part of the cultivation, and are to be performed by the wife and children. By daily attention to the progress of the plants, and continual assistance at critical periods, sometimes thinning out, and at other times transplanting to produce an equal crop, and treating every plant as if it were a rare plant in a garden, the ground may be made to produce more than double what the most attentive farmer could expect on a larger scale. The additional labour, which is all light, costs the cottager nothing; but the farmer could not afford to pay for it at the usual rate of wages. If he could find hands to do it, he could not insure the minute attention which is naturally applied when the labourer is to receive all the advantage himself. The comfort which a well-managed allotment gives to a labourer with a numerous family is hardly credible by those who have not witnessed it; and if there were less profit, it would still be highly beneficial, in a moral and political point of view, that early habits of industry should be encouraged, and that the temptations which arise from want of employment should be taken away from the young by the useful and healthy occupations of the garden.

GARDINER, STEPHEN, Bishop of Winchester and Lord Chancellor of England, although he was called by another name, was believed to be the illegitimate son of Dr. Woodvil, bishop of Salisbury, who being brother to Elizabeth, Edward IVth's queen, was also related to Henry VIII. He was born at Bury St. Edmunds in 1483. His studies at Trinity Hall, Cambridge, were directed not only to Latin and Greek, but also to civil and canon law, and it was partly his skill in this latter branch of learning that led to his future greatness. When master of Trinity Hall, through his intimacy with the Duke of Norfolk he became acquainted with Wolsey, who afterwards made him his secretrary, and in this capacity he was brought under the notice of the king, with whom he rapidly ingratiated himself. An office of trust was soon committed to his charge. Dr. Stephens (as Gardiner at this time was usually called) was sent to Italy in 1527, to procure the pope's consent to the divorce of Catherine of Aragon, and no better proof can be given of his high favour with Henry than the fact that from Rome he wrote a letter to the king so private that even Cardinal Wolsey was not to see it. (Burnet's *Reformation*, where the letter is given.) Though he failed in the object for which he was sent to Rome, he rendered services at this court both to the bishop of Norwich (who afterwards rewarded him with the archdeaconry of Norfolk), and to Wolsey by promoting his interests as a candidate for the papal throne. He was recalled from Rome to manage the process for the divorce in England; and because he was esteemed the greatest canonist of his time, the king would commence no proceedings until he returned. After his arrival he was made secretary of state, and having in the spring of 1531 been further advanced to the archdeaconry of Leicester, was installed bishop of Winchester in the following November. We pass over his embassies to France and Germany in order to speak more fully of his opposition to all such measures as were intended to procure a religious reformation in England. Gardiner was attached to the doctrines and forms of the Roman Catholic church; he was believed to have already reconciled himself to the pope, with whom he had had differences while urging the divorce: and he had no sooner returned to England than he urged the king to punish the sacramentaries (persons who denied the corporal presence of Christ in the eucharist) and to turn a deaf ear to the proposals of the reformers. It was impolitic, he said, to offend the pope, not only on account of the power of the holy see itself, but because the emperor would break off all commerce with him if he went to extremities against the Roman Catholic religion.

His advice was partially taken, the innovations of the reformers were obstructed, and Lambert and others were condemned and executed for their heretical opinions. 'He was opposed' says Burnet, 'to *all* reformation:' both the free use of the Scriptures and their translation into English he considered to be highly objectionable; to the disuse of confession and the omission of certain sacraments he was equally averse; and he was altogether opposed to the measures of Cranmer and his associates. He had certainly endeavoured to dissuade the king from listening to Cranmer's proposals for furthering the Reformation. The emperor, he said, threatened to break off all commerce with him, if he went to extremities against the Roman Catholic religion. In the promotion of the act of the six articles (1538), and in the subsequent enforcement of its provisions, the extent of his hostility to the reformation was most evidently displayed. The decline of Cromwell's power tended greatly to increase his authority and influence. Both these crafty statesmen had at the same time been servants to Cardinal Wolsey, the one as his secretary, the other as his solicitor, and both had risen through Wolsey's patronage: but as they had espoused opposite parties, their friendship was at an end, and Gardiner's jealousy of the vicar-general was without bounds. When circumstances [CROMWELL] weakened the king's confidence in the bishop's unpopular rival, he craftily assisted in his downfall, and prepared to occupy his place in the good graces of the king: the fate of Cromwell was soon sealed; a fallen favourite has few friends, and crimes were soon proved which ensured his execution (1540). It now became Gardiner's object to use all means to obtain the favour of the king. The disgust of Henry at his new queen, Anne of Cleves, was so rapidly conceived that he had scarcely married her before he began to talk of a divorce. There was no just ground whatsoever for such a separation: nevertheless Gardiner, though an accurate lawyer, promoted the king's suit. The divorce was procured, but Henry, though well aware of the assistance that Gardiner had rendered to his cause, did not wholly trust him. A perception of his excessive cunning appears to have estranged his confidence. The abilities of Gardiner were undeniable; he had also a powerful party at his side: nevertheless he could only obstruct and hinder, not wholly set aside, the measures of his opponents. The king befriended Gardiner, but he never ceased to befriend Cranmer also.

An evidence of his friendship for Cranmer is shown by his conduct to the archbishop on an occasion in which his life was in danger. The Roman Catholic party, with the bishop of Winchester at their head, attempted to attach the crime of heresy to Cranmer; but the king himself delivered a message to him to prepare him for the threatened attack, taking care afterwards to appoint such a tribunal to investigate the charges as should defeat the object of his accusers. The popularity of Gardiner indeed was not injured by the failure of this conspiracy; his restless spirit however was soon employed in another scheme, the consequences of which were not equally harmless to him. The queen (Catherine Parr) who was secretly a great favourer of the reformers, and had admitted their preachers into her apartments, in conversation with the king, whose illness added to his ordinary impatience, maintained the new doctrines, discoursing very warmly upon the subject. This vexed the king, who communicated his displeasure to Gardiner, who to please his master (as he thought), now began to plot against the queen, going so far as to write articles of impeachment against her. In this attack the chancellor was associated with him; and through an accident occasioned by him, the queen discovered the conspiracy, and was able to defeat its end. The chancellor inadvertently dropped within the palace the paper on which the articles of impeachment were written: it was picked up and given to the queen by one of her women, and by her good sense and character, which gave her great influence over the king's mind, coupled with considerable adroitness of management, she escaped the accusation. The day had been named for carrying her to the Tower; but when her accusers came before the king he railed at them with the most violent abuse. Gardiner wes never able to regain his favour or his countenance. (Burnet.)

At Henry's death Gardiner experienced a still greater reverse. The young king and his government proceeded to make further religious changes; the use of holy water was decried, and homilies were composed which the clergy, who had abused their power of preaching, were ordered to substitute for sermons: a general visitation also was ordered, at which the new articles and injunctions were to be circulated. These things offended Gardiner, and he totally condemned them in no measured terms. If this behaviour was rash, it was also high-spirited and consistent. The consequences followed, as might have been foreseen. The

council, on his refusal to comply with their injunctions, committed him to the Fleet. Here he was confined until the act of general amnesty, which passed in the December after the accession of Edward, released him. As soon as he was free he went down to his diocese, and while there he remained unmolested; but on his return to London, on account of a certain sermon which he preached on St. Peter's Day, he was seized and committed to the Tower (1548). Various conferences were held with him, and his release was promised him on condition that he would express his contrition for the past, promise obedience for the future, subscribe the new settlement in religion, also the king's complete power and supremacy, though a minor, together with the abrogation of the six articles. With the first of these conditions alone did he absolutely refuse to comply. The terms of liberation were afterwards rendered still more difficult. The number of articles that he was called upon to subscribe was considerably increased. On his refusal to sign them, his bishopric was sequestered, and he was soon afterwards deprived. For more than five years he suffered close imprisonment, and it was not until the beginning of the reign of Mary that his liberty was restored (1553). If his fall from power at the conclusion of Henry's reign had been great and sudden, still greater and still more sudden was the rapidity of his reinstatement. A Catholic queen was on the throne, and he who had been ever the foremost of her partisans must necessarily be raised to be one of her first advisers. The chancellorship was conferred upon him. His bishopric was restored, and the conduct of affairs placed in his hands. The management of the queen's marriage treaty was intrusted to him. He was chosen to officiate at her marriage, as he had also done at her coronation, and became her most confidential adviser. No matters, whatever they might be, could be proceeded in without his privity and concurrence. We must refer our readers to the ecclesiastical and general histories, and to Burnet's 'History of the Reformation,' for an account of his share in the persecutions of this reign. Those horrors which were not committed by his actual orders must at least have obtained his sanction; for he had reached a height of power, both civil and ecclesiastical, perhaps unequalled in this kingdom, except by his master Wolsey alone. He died on the 12th of November, 1555. His funeral was conducted with great pomp and magnificence. A list of his writings is given in Tanner's 'Bibl. Britannica,' Hibernica, p. 308.

The character of Gardiner may be stated in a few words. He was a man of great ability; his general knowledge was more remarkable than his learning as a divine: he was ambitious and revengeful, and wholly unscrupulous; his first object was his own preservation and advancement, and his next the promotion of his party interest. He saw deeply into the characters of those with whom he dealt, dealt with them with infinite tact, and had an accurate foresight of affairs. (*Ecclesias Hist.*; Burnet's *Reform.*; &c.)

GARFAGNA'NA is a highland district of the northern Apennines, on the borders of the states of Tuscany, Genoa, and Modena, including the valley of the Upper Serchio above its junction with the Lima. The valley extends from the sources of the Serchio in a south-east direction for about twenty-four miles between the main ridge of the Apennines and the lofty group called Alpe Apuana, which divides the valley of the Serchio from that of the Magra, and also from the maritime districts of Carrara, Massa, and Pietrasanta.

high. The climate of Garfagnana is cold and foggy, and exposed to boisterous winds from the mountains. The inhabitants of this secluded district amounted in 1832 to 40,160. The low lands of the valley produce some corn, hemp, and flax, and in some sheltered and favoured spots the olive and mulberry: but the main resource of the people is their pastures and their forests of chestnut-trees, the fruit of which is to them a substitute for bread. In 1832 they had 8836 head of horned cattle, 47,505 sheep, 6958 goats, 1867 pigs, 255 horses, 624 asses, and 172 mules. In the same year they exported 40,000 lbs. of silk cocoons; other exportations are cheese, undressed skins, chestnuts, wool, and timber. There are also iron and coal-mines. The Garfagnana contains sixty-seven parishes, and is divided for administrative purposes into six jurisdictions, three of which belong to the duchy of Modena, two to the duchy of Lucca, and one to Tuscany. The principal towns are—1. Castelnuovo, with 2400 inhabitants, and some good buildings, being the residence of the Modenese governor; it has a college, an hospital, and a Monte di Pietà. The poet Ariosto was at one time governor of this place, of which he gives a curious account. [ARIOSTO.] 2. Gallicano, with about 1000 inhabitants, the head place of the district, and belonging to Lucca. 3. Barga, with 2500 inhabitants, head town of the district, and belonging to Tuscany.

GARLIC, a hardy perennial plant with bulbous roots, found growing wild in the island of Sicily, and in several other parts of the south of Europe. In gardens it is cultivated chiefly on account of its bulbs, which are much used in cookery, and occasionally in medicine.

It is the *Allium sativum* of botanists, and is regularly grown for the market. For this purpose, a light tolerably rich soil is selected in a dry warm situation. The ground should be well dunged for the crop which precedes garlic; and not when the garlic is planted, because, when this is done, the bulbs are very apt to canker and to be infested with maggots.

It may either be planted in beds or in rows; if in beds, the distance between the plants may be seven or eight inches; if in rows (which is most recommended), they may be one foot apart, and six inches between the plants in the row. In gardens where the soil is light and dry, the best season for planting is late in autumn; but where the soil is wet, the operation should be deferred until spring, that is, to any time in February or March.

The plant is propagated by offsets, which it produces annually in considerable numbers, and which are commonly called cloves. The season of ripeness, which is generally in the end of July or August, is easily known by the leaves changing from green to yellow. At this period the bulbs should be taken up and spread out in the sun to dry, after which they may be tied in bunches and kept in a dry house for winter use, in the same way as onions.

GARNET, a well-known precious stone, of which there are many varieties. Some of them are probably distinct species; but agreeing in form, and some other properties, they are classed together. This mineral occurs crystallized, massive, and granular. The primary form is a cube, but it occurs in the form of a rhombic dodecahedron. The colour is various, and accordingly, as will be seen below, it has received different names. It is transparent, translucent, rarely opaque. Lustre vitreous, resinous. Specific gravity, 3·6, 4·2. Hardness, 6·5, 7·5. Cleavage parallel to the planes of the rhombic dodecahedron; fracture, uneven.

This mineral occurs in the mountainous parts of most countries.

The massive varieties are amorphous, structure granular, compact. The crystalline varieties, according generally to their colour, have received various names. Precious garnet, *Almandine*; black, *Melanite, Pyreneite*; greenish-yellow, *Grossularia*; yellow, crystallized, *Topazolite*; granular, *Succinite*; brownish-yellow, granular, *Colophonite*; greenish, compact, *Allochroite*; red, *Pyrope*, *Carbuncle*; reddish-brown, *Essonite*, *Cinnamon-stone*, *Romanzovite*; magnesian, *Rothoffite*.

The following are the analyses of the almandine, by the authors named, and from the places mentioned:—

	Bohemia.	New York.
Silica	33·75	42·51
Alumina . . .	27·25	19·15
Oxide of Iron . .	36·00	33·57
Oxide of Manganese	0·25	5·49
Lime . . .	0·00	1·07
	97·25 Klaproth	101·79 Wachtmeister

It appears that the essential ingredients of the garnet are silica, alumina, and oxide of iron; these are frequently partially replaced by oxide of manganese, lime, and magnesia.

GARNET, HENRY, superior of the Jesuits in England, was the son of a schoolmaster at Nottingham, and was born about the year 1554. He was educated in the Protestant religion at Winchester College, whence it was intended that he should go to New College, Oxford, and his not having done so has been assigned to different causes by Protestant and Catholic writers. He removed from Winchester to London, where he became corrector of the press to a celebrated law-printer; and having turned Roman Catholic, travelled first to Spain and thence to Rome, where he entered the society of Jesuits in 1575. In the Jesuits College, at Rome, he studied with great indus-

try, became professor of Hebrew and teacher of the mathematics, and obtained such credit, that in 1586 he was appointed to the English mission. Two years afterwards he was name Superior of the English Jesuits, the duties of which office he discharged with zeal and punctuality. For several years previously to the Powder Plot he remained in the neighbourhood of London, following various occupations in order to disguise his real calling. He was well known to have been implicated in the treasonable intrigue with the king of Spain immediately before the death of Queen Elizabeth, and was suspected of other seditious practices. In order to protect himself from penal consequences, he purchased a general pardon upon the accession of James I. His association with disaffected recusants exposed him to the continued suspicion of the government, who did not regard him more favourably for that he was intimate with many of the Catholic nobility, more especially with Lord Vaux, whose eldest daughter, Anne Vaux, after her father's death followed the fortunes of Garnet with singular attachment. In September, 1605, a pilgrimage to St. Winifred's Well, in Flintshire, was undertaken by Garnet, in company with persons who were actively concerned at that time in the promotion of the Gunpowder Plot; and it is suspected that this unusual proceeding must have had some reference to the great blow that in two months afterwards it was intended to strike for the Roman Catholic church. When the Powder Plot was discovered, Garnet was in the neighbourhood of Coughton, the general rendezvous of the conspirators; but he removed for greater safety to Hendlip Hall, near Worcester, at the request of one Hall, otherwise called Oldcorne, a Jesuit, who was domestic priest to Mr. Abington, the brother-in-law of Lord Mounteagle, and proprietor of that house. In Hendlip (*Beauties of England*, vol. xv. p. 184) were many secret passages and hiding-places which served for concealment, and to one of these Garnet and Oldcorne were soon forced to retreat; for Sir Henry Bromley, commissioned by lords of the council, invested the house, and vigorously searched every room. A bill of attainder was introduced into parliament, which recited that Garnet, Greenway, Gerard, Creswell, Baldwin, Hammond, Hall (Oldcorne), and Westmorland, all Jesuits, had been guilty of treasonable correspondence with Spain, after and before the death of Queen Elizabeth. Father Gerard fled to the Continent; Father Greenway also, after very narrowly escaping an arrest, landed in Flanders; but Garnet and Oldcorne were not so fortunate. Being cramped for want of space within their hiding-place at Hendlip, they were compelled to leave it after a confinement of seven days and as many nights, and were seized and conveyed to London (Feb. 12, 1606). The lords had now determined to proceed against them as conspirators in the Powder Plot. Evidence sufficient for their conviction had not yet been obtained, but every method was used to procure it, and these methods soon proved to be effectual. Oldcorne was tortured; Garnet's letters were intercepted: conversations were promoted between the two prisoners, who, while they thought themselves in private, were in fact secretly listened to by spies, who wrote down their words, and other unfair practices were also used; but for these, as for Garnet's view of equivocation (p. 315), we must refer to Mr. Jardine's curious account of Garnet's trial. (*Criminal Trials*, vol. ii) The guilt of both prisoners was proved: Garnet was hanged in May, 1606, in the city of London; Oldcorne had been executed at Worcester in the preceding month: they were both considered martyrs by the Roman Catholics.

It is certain that more English Jesuits than we have named were at least aware, if they did not take a part in the conspiracy, of the Powder Plot. It is also probable that there were persons upon the Continent who, through Fawkes, Bayham, or other conspirators, had become acquainted with the intended treason. But it does not appear that any body of Jesuits, either at home or abroad, were formally led to expect that an attempt was to be made to restore the Roman Catholics to power; much less by what means the attempt would be made.

GARNIER, JEAN JAQUES, was born in 1729, in the province of Maine, of poor parents, who gave him however a superior education. Without money or interest he left his home at the age of eighteen, and travelled on foot to Paris, where a happy chance made him acquainted with the sub-principal of the college of Harcourt, who perceiving his uncommon talents and acquirements, took him under his patronage, and procured him a situation at the abovementioned college. About 1760 he was appointed professor of Hebrew at the Collège de France, of which he afterwards became inspector. On the death of Villaret in 1766 he was appointed historiographer of France, in which capacity he published in 1770 the 9th volume, in 4to., of Vélly and Villaret's 'History of France,' beginning with the year 1469. Continuing his labours on this work, he produced the 13th volume, which brings the history of France down to the middle of the reign of Charles IX. He was the author of the following works:—'L'Homme des Lettres,' Paris, 1764, 2 vols., in 12mo., in which he lays down an ingenious method for forming a man of letters; 'Traité de l'Origine du Gouvernement François,' Paris, 1765, 12mo.; 'Le Commerce remis à sa Place,' 1757, 12mo; 'Le Bâtard Légitime, ou le Triomphe du Comique Larmoyant,' 1757, 12mo. He also wrote several papers in the 'Memoirs of the Academy of Inscriptions;' and among other subjects, on the philosophy of the antients, and especially on that of Plato, of which he was a great admirer. Garnier died in 1805, at the age of seventy-five.

GARONNE, a river of France (the *Garumna* of the Romans). [France, vol. x., pp. 408 and 423.] We here subjoin the official statement of the length of the navigation of the rivers which form the system of the Garonne.

	miles.
Garonne and Gironde	281
Tributaries of the Garonne, arranged in the order in which they fall into it:—	
Salat (right bank)	10
Ariège (do.)	19
Tarn (do.)	90
Gers (left bank)	1
Bayse (do.)	15
Lot (right bank)	190
Dropt (do.)	[illegible]
Dordogne (do.)	182
Tributaries of the Dordogne:—	
Vezère (right bank)	29
Isle (do.)	90
Tributary of the Isle:—	
Dronne (right bank)	1
Total navigation of the system of the Garonne	960

The navigation of the Garonne is in the upper part much impeded by a variety of obstacles, as rocks, and the trunks of trees that have been rooted up. These obstacles continue below Toulouse, and even below the confluence of the Tarn. At Bordeaux the river forms a fine haven, capable of containing 1000 sail of ships. The tide rises here from 12 to 18 feet, and flows considerably higher up the stream: it is perceptible at St. Macaire, about 24 or 25 miles above Bordeaux, where there is a considerable bend in the river. The conflict of the tide coming in with the descending water in the Gironde is fearful: boats are in danger of being carried from their moorings and swamped by it. The French call this phenomenon '*Le Mascaret*.' There are several sandbanks in the Gironde.

The Garonne serves for floating timber, and (on rafts) blocks of stone from the Pyrenees, from the point where it enters France; for its source is beyond the frontier, in the kingdom of Spain.

GARONNE, HAUTE, a department in the south of France, deriving its name from the river Garonne, which has the upper part of its course in the department. It is bounded on the north by the department of Tarn et Garonne; on the north-east by that of Tarn; on the south-east by those of Aude and Ariège; on the south by the kingdom of Spain, from which it is separated by the Pyrenees: on the south-west by the department of Hautes Pyrénées; and on the north-west by that of Gers. Its greatest length is, from north-east to south-west, 98 or 100 miles; its greatest breadth, at right angles to the length, is 63 miles. It is comprehended between 42° 39′ and 43° 54′ N. lat., and 0° 26′ and 2° 4′ E. long. Its area is about 2394 English square miles, being rather more than the conjoint areas of the English counties of Dorset and Wilts. The population, by the census of 1836, was 454,727, giving about 190 to a square mile. In extent it is a very little above the average of the departments; but both in absolute and relative population it very much exceeds the average, and also

far surpasses the English counties with which we have compared it. Toulouse, the capital, is on the right bank of the Garonne, in 43° 36′ N. lat., and 1° 26′ E. long., about 363 miles in a straight line west-by-south of Paris. It had in 1831 a population of 59,630; in 1836, of 77,372.

Surface; Hydrography; and Communications.—The southern part of the department is covered with lofty mountains, forming the principal range or the branches of the Pyrenees. The Pic Quairat, 9964 feet high, and Mont Carbère or Crabère, 8655 feet high, are in or close upon the border of the department. The lower slopes are covered with thick forests, or are occupied as sheepwalks or pasture grounds. The mountains are intersected by beautiful valleys, such as that of Luchon, and are crossed by the various ports or passes by which communication is kept up between France and Spain. The northern part of the department is occupied by hills of moderate elevation, separated by extensive plains.

The Garonne enters the department from the valley of Arran, in Spain, and traverses it in its whole length in a circuitous course from south to north.

The other rivers which water the department belong to the system of the Garonne: the principal are the Nesle, the Salat, the Ariège, the Lers, the Lougé, the Touch, the Save, the Gimone, and the Tarn.

The Canal du Midi, or Canal du Languedoc, commences in the Garonne at Toulouse, and follows the valley of the Lers into the department of Ariège. There is another small canal in the department, the canal of St. Pierre. The official return of the extent of water conveyance in this department is as follows:—

Navigation of Rivers.

Garonne	70 miles.
Salat	10 „
Ariège	19 „
Tarn	14 „
River navigation	113 miles.
Canals.	
Canal du Midi	32 miles.
„ of St. Pierre	1 „
Total water communication	146 miles.

The number of *Routes Royales* or government roads in the department is seven, in all states of repair and completeness; their aggregate length is nearly 200 miles. None of these roads are of the first class. One road of the second class, coming from Paris by Limoges, Cahors, and Montauban, crosses the department from north to south, through Castelnau and Toulouse to Pamiers (dep. of Ariège), and so into Spain. The other roads are of the third class.

There are about thirty *Routes Départementales*, or roads under the direction and at the charge of the local government, having an aggregate length of 476 miles; and a vast number of bye-roads or paths (*chemins vicinaux*), amounting in their total length to above 8000 miles. The *Routes Royales* are, on the whole, in tolerable repair; but of the *Routes Départementales* one-fifth only are in good repair. There are no railroads in the department.

Geology and Mineralogy.—The greater part by far of the department is occupied by the supercretaceous strata, which extend from the northern boundary to the junction of the Garonne with the Salat and the Nesle. The chalk formation does not rise to the surface: the oolitic or other formations between the chalk and the red marl or new (saliferous) red sandstone crop out from beneath the supercretaceous strata, and occupy a narrow belt to the south of these. The Pyrenees are formed of the older limestones and other primitive rocks. The various mineral treasures of the department are in a great degree neglected. There are ores of iron, copper, lead, antimony, bismuth, and zinc; slates, gypsum, and various species of marble and other limestones, and of granite. There are two brine springs and several mineral waters, of which the most celebrated are those of Bagnères de Luchon. [BAGNERES DE LUCHON.]

Climate; Soil; Agricultural Produce; Animals.—In the higher parts of the mountains the winters are severe and long; in the lower hills and plains, which make up the greater part of the department, the climate is mild; it rarely freezes, and a fall of snow is almost unknown. The medium temperature in winter is from 36° to 39° Fahrenheit; that of spring and autumn from 59° to 64°, and that of summer from 81° to 86°; the average number of days in the year in which rain falls is 100. The east and west winds predominate; the latter brings cold and rain. Tempests are frequent and violent. Catarrhal and rheumatic disorders and remittent fevers are common; goitres and diseases of the eyes are frequent in the mountainous country, especially on the banks of the Garonne.

The soil is thus divided:—mountains, 125,957 acres; heaths and moors, 81,502; rich loamy soil, 7,409; calcareous, 254,384; gravelly, 185,231; rocky or stony, 111,138; sandy, 338,355; clayey, 271,672; various, 152,033: total, 1,527,681 acres.

In the mountainous tracts it is only by dint of industry that any returns can be procured by the farmer. The most fertile localities are the neighbourhood of Toulouse, the productiveness of which in corn was noticed by Cæsar ('Locis patentibus maximèque frumentariis:' *De B. G.*, lib. i. 10); and of Rieux; and other parts of the valley of the Garonne: at Rieux two harvests are obtained in the year. The soil, according to its occupation, is distributed as follows: arable, 870,383 acres; meadows, 97,893; vines, 120,790; woods, 215,214; orchards, gardens, and nurseries, 13,749; osier and willow plots, 96; various, 7,841; heaths, commons, pastures, &c. 114,087; pools, ponds, ditches, 1,008; lakes, rivers, brooks, 11,551; forests, and non-productive occupations, 35,290; not accounted for, 39,779: total, 1,527,681 acres.

The arable land is chiefly devoted to the cultivation of wheat, maize, millet, rye, and other grains and pulse. The following is nearly the proportion in which the various kinds of grain are cultivated, taking as the basis of our calculation the official return of the quantity of land sown for the various crops in the year 1835. Wheat, 56·5 acres out of every 100 of arable; maslin, 3·5; rye, 9·5; barley, 1·; buckwheat, 1·5; maize and millet, 21; oats, 3; peas, beans, and other pulse, 3·5; potatoes, &c. ·5.

The quantity of wine grown in the department is considerable, though far from equal to what is grown in many other departments. The uplands and the valleys furnish abundance of excellent pasture; the mountains abound with wood, suited for ship-building.

Many oxen are bred in the extensive pastures of this department; also many asses and mules, which are much sought after by the Spaniards. There are sheep and swine; the poultry are good, especially that of Ile-en-Dodon. The geese and ducks are of great size; numbers of them are salted: the duck's-liver pies of Toulouse are highly esteemed by epicures. The care of bees and of silkworms appears to have been long declining. Game and wild animals are plentiful. In the mountains there are the wild boar, the roe-buck, the wolf, the fox, and other beasts; the heath-cock, and different varieties of the eagle. The partridge, the ortolan, and the quail, are taken in abundance in the plains. The rivers and lakes abound with fish; the lakes contain excellent trout.

Divisions, Towns, &c.—This department is composed of portions of Languedoc and of Gascogne (Gascony): Le Toulousain, or county of Toulouse (comprehending the dioceses of Toulouse and Rieux), a small part of the district of Le Lauraguais in Languedoc; and portions of the districts of Comminges, and of Couserans, and of Nebouzan, Les Quatre Vallées, Lomagne, Rivière, Verdun, and the county of Ile Jourdain, subdivisions of Armagnac in Gascogne, are comprehended within it.

It is subdivided into four arrondissements, as follows:—

Capital.	Population in 1831.	Population in 1836.	Situation.	Area, sq. miles.	Population of arrondis. 1831.	Population of arrondis. 1836.
Toulouse,	59,630	77,372	N.	612	139,927	159,064
Villefranche,	2,652	2,765	E.	359·5	61,251	63,101
Muret,	3,787	3,970	Central & W	604	86,709	88,994
St. Gaudens,	6,179	6,020	S and S.W.	818·5	139,969	143,568
				2,394·	427,856	454,727

The department comprehends 39 cantons and 599 communes.

In the arrondissement of Toulouse, besides the capital [TOULOUSE], there are Grenade (population, 2670 town, 4240 commune), a neat town on the Garonne; Villemur (pop. 3186 town, 6063 commune), an ill-built town; Bessières and Buzet, all on the Tarn; Castanet, near the Canal du Midi; Castelnau, on the road from Paris to Toulouse; Fronton, Montastruc, Verfeil, and Lavignac.

In the arrondissement of Villefranche are the chief town, distinguished from other places of the same name, as Villefranche de Lauraguais, Montgiscard, Montesquieu, Avignonet, and Baziège, all on or near the Canal du Midi; Caraman, Auriac, St. Felix, Revel (pop. 4540 town, 5456 commune), Lanta, Loubens, and Nailloux. Revel, situated on a height, which commands one of the most fertile and beautiful plains in the district, was, in the religious contests of the sixteenth century, one of the strongholds of the Huguenots. The fortifications were razed A.D. 1629.

In the arrondissement of Muret are the chief town, Muret, Martres, Cazères (pop. 1903 town, 2597 commune), where the navigation of the river begins; St. Julien, Carbonne, and Noé, all on the Garonne; Cintegabelle (pop. 3738 commune), Auterive (pop. 2000 town, 3172 commune), where the navigation commences, and Venerque, all on the Ariège; St. Sulpice, on the Lèze; Miremont, on the Mouillone: Grailhac, on the Marens; and Calmont, on the Lers, feeders of the same stream; Rieumes, Sainte Foy, and St. Lys, all on feeders of the Touch; Fousseret, near the Lougé; Montesquieu de Volvestre (pop. 2182 town, 3717 commune), and Rieux, formerly the seat of a bishopric, on the Arize, which flows into the Garonne; Montbrun, on a feeder of the Arize; and Le Plan, on the Volp, a small feeder of the Garonne. Muret is celebrated for a great battle fought under its walls in the 13th century. Pedro II., king of Aragon, and the Count of Toulouse, the protectors of the Albigeois, had besieged the town A.D. 1213. St. Dominic, who was shut up in it, called to his succour Simon de Montfort, general of the Crusade against the Albigeois, who with a much smaller force routed the besieging host; the king of Aragon fell in the battle. Earthenware and coarse woollen cloth are now manufactured at Muret and at Montesquieu de Volvestre.

In the arrondissement of St. Gaudens are the chief town, St. Gaudens: Valentine, which is so near to it as to be almost a suburb, St. Beat, St. Bertrand de Comminges Monrejeau or Montrejeau (pop. 1801 town, 2991 commune), and St. Martory, all on or near the Garonne; Bagnères de Luchon, described elsewhere [BAGNERES DE LUCHON], on the Pique; Aspet (pop. 5575 commune) and Soueich, on the Ger, a small affluent of the Garonne; Salies, on the Salat; Aurignac, near the Lougé; St. Blancard and Ile-en-Dodon, on the Save; Puymorin, on the Gesse, a feeder of the Save; and Boulogne (pop. 1505 town, 1587 commune), on the Gimone, which flows into the Garonne through the departments of Gers and Tarn et Garonne. St. Gaudens is the centre of a considerable trade with Spain. Some woollen cloth is manufactured, also tapes, hats, hosiery, leather, and paper. There are a high school and an agricultural society. This town was the capital of Nebouzan. St. Bertrand de Comminges, capital of Haut or Upper Comminges, is nearly on the site of a Roman town mentioned by Strabo and Ptolemy, under the name of Lugdunum Convenarum. This town was destroyed A.D. 585 by Gontran, king of the Burgundians. It was rebuilt early in the 12th century by Atton Raimond, lord of Ile Jourdain, and St. Bertrand, bishop of Comminges, from the latter of whom it took its name. There are many remains of Lugdunum, but principally out of the present town (which is very small, having a population under 1000), at the foot of the hill on which it is situated. The seat of the bishopric of Haut Comminges, established in the 6th century, was fixed here.

The population of the towns is (when not otherwise mentioned) from the cenus of 1831.

The department is comprehended in the tenth military division, of which the head-quarters are at Toulouse. It constitutes the metropolitan diocese of Toulouse; and is comprehended in the jurisdiction of the Cour Royale, and the circuit of the Académie Universitaire of that city. It sends six members to the Chamber of Deputies.

GARRICK, DAVID, descended from a French Protestant family of the name of Garric, or Garrique, was born on the 20th of February, 1716, at the Angel Inn, Hereford. His father was Captain Peter Garrick, of the Old Buffs, then recruiting in that city, and his mother, whose maiden name was Arabella Clough, was the daughter of one of the vicars of Lichfield Cathedral. David was baptized on the 28th of February, according to the register of the church of All Saints, Hereford. At ten years of age he was placed under the care of Mr. Hunter, master of the grammar-school at Lichfield; and in 1727 showed his predilection for the stage by performing Serjeant Kite, in Farquhar's comedy of the 'Recruiting Officer.' Shortly afterwards he went to Lisbon on a visit to his uncle, a wine-merchant there, and by his agreeable manners became a great favourite not only with the English residents, but amongst the young Portuguese nobility. In the following year he returned to his school at Lichfield, and during occasional visits to London encouraged his growing passion for theatricals. In 1735 he became the pupil of Dr. (then Mr.) Samuel Johnson, with whom, on the 2nd of March, 1736, he set out for the metropolis, and on the 9th of the same month entered himself in the Society of Lincoln's Inn. In 1737 he commenced a course of studies under Mr. Colson, the mathematician, at Rochester. Shortly afterwards, on the death of his father, he commenced business as a wine-merchant, in partnership with his elder brother, Peter Garrick. This partnership was however soon dissolved, and in 1741 David Garrick finally resolved upon the profession of the stage, and made his first appearance at Ipswich under the name of Lyddal, and in the part of Aboan, in the tragedy of 'Oroonoko.' His success was undoubted, and he soon became a great favourite in that town, playing not only tragedy and comedy, but exhibiting his grace, humour, and agility as harlequin. In the autumn he returned to London with the manager of the Ipswich company, who was also proprietor of the theatre in Goodman's Fields: and on the boards of that establishment Mr. Garrick made his first appearance as Richard III., October 19th, 1741. The fame of the young actor, then only in his twenty-sixth year, spread in a few weeks throughout the metropolis; and from the time of his first benefit, December 2nd, on which occasion he performed Lothario, in the 'The Fair Penitent,' persons of every condition flocked from all parts of the town to see him, and entirely deserted the theatres at the West-end. At the close of the season, May 26, 1742, Mr. Garrick played three nights at Drury Lane theatre, as Bayes, Lear, and Richard, and then set off for Dublin, accompanied by Mrs. Woffington. In Ireland he sustained his reputation, and the theatre was crowded to such a degree as, in conjunction with the heat of the weather, to produce an epidemic, which was called *the Garrick fever*. He returned to London for the winter season, and commenced an engagement at Drury Lane on the 5th of October, as Chamont, in Otway's tragedy of 'The Orphan.' In 1745 he again visited Dublin, and became joint manager with Mr. Sheridan, of the Theatre Royal in Smock Alley. In 1746 he returned to England, and was engaged for the season by Mr. Rich, the patentee of Covent Garden theatre, on the close of which he purchased, in conjunction with Mr. Lacy, the Theatre Royal, Drury Lane (Mr. Fleetwood's patent having expired), and opened it on the 15th of September, 1747, with the play of 'The Merchant of Venice,' to which he spoke the well-known prologue written by Dr. Johnson.

On the 22nd of June, 1749, Mr. Garrick married Eva-Maria Violette (not Violetti, as generally written), the daughter of a respectable citizen of Vienna, who having been educated as a dancer, had made her first appearance at Drury Lane on the 3rd of December, 1746. Her real family name was Veigel, which in the Viennese patois signifies Violet, and she assumed the name of Violette by command of the empress Maria Theresa. Mr. and Mrs. Garrick were married first by Mr. Francklin, at his chapel near Russell Street, Bloomsbury, and afterwards, on the same day, by the Rev. Mr. Blythe, at the chapel of the Portuguese embassy, in South Audley Street, according to the rites of the Roman Catholic church.

On the 7th of September, 1769, Garrick put into execution his favourite scheme of the Jubilee in honour of Shakspeare, at Stratford-upon-Avon, and produced a pageant on the subject at Drury Lane in the following October. On the 10th of June, 1776, having managed Drury Lane theatre for twenty-nine years (with the exception of two passed abroad, 1763 and 1764), Garrick took his leave of the stage in the character of Don Felix, in 'The Wonder,' the performances being for the benefit of the fund for decayed actors. In 1777 Mr. Garrick was honoured by the command of their Majesties King George III. and Queen Charlotte to read a play at Buckingham House. He selected his own farce of 'Lethe,' introducing for the occasion the character of an ungrateful Jew, but having been so long accustomed to the thunders of applause in a theatre, the refined approbation of the Royal party threw, to use his

own expression, 'a wet blanket' over him. In the same year he was put into the commission of the peace.

At Christmas, 1778, while on a visit to Lord Spencer, at Althorpe, he had a severe fit, from which he only recovered sufficiently to enable him to return to town, and expired January 20th, 1779, at his own house in the Adelphi, having nearly completed his 63rd year. He was buried with great pomp in Westminster Abbey on the 1st of February.

As an actor Mr. Garrick's merits may be considered as summed up in the forcible words of Pope to lord Orrery on witnessing the performance of Richard—'That young man never had his equal as an actor, and will never have a rival.' As yet the prophecy is unshaken. Garrick was an excellent husband, a kind master, and a matchless companion. The charge of avarice so frequently made against him is disproved by a careful examination of his life. His latest biographer justly says, 'He loved affluence for its independence, and the power it bestowed of obliging the great and relieving the humble.' He was one of the most accomplished men of his day, and although his literary reputation is merged in the splendour of his histrionic fame, his rank as a writer of prologues and epilogues, and in the lighter kinds of verse, must be generally acknowledged as considerable. His alterations and adaptations of popular English and French plays were numerous and successful, and with the addition of his original contributions to the drama, exceed forty. The best known to the present generation of play-goers is the farce of 'The Lying Valet,' and the comedy of 'The Clandestine Marriage,' of which latter he was joint author with the elder Colman.

Mrs. Garrick survived her husband forty-three years, and expired suddenly in her chair after a short indisposition, at her house in the Adelphi, on the 16th of October, 1822, in the ninety-eighth year of her age, having retained her faculties to the last. She was buried October 25th, in the same grave with her husband, near the cenotaph of Shakspeare.

Garrick's private correspondence, with a new biographical memoir, was published in two volumes, 4to., London, 1831.

GARROW HILLS. [HINDUSTAN.]

GA'RRULUS. [CORVIDÆ, vol. viii., p. 69.]

GARRYA'CEÆ, a very small natural order of Exogens with the habit of a Viburnum and apetalous unisexual flowers, succeeded by succulent fruit, disposed in catkin-like racemes. One species only is known, the Garrya elliptica, figured and described in the 'Botanical Register,' vol. 20, plate 1686.

GARTER, ORDER OF THE, one of the most ancient and illustrious of the military orders of knighthood in Europe, was founded by King Edward III. The precise year of its institution has been disputed, though all authorities agree that it was established at Windsor after the celebration of a tournament. Walsingham and Fabyan give 1344 as its date; Stowe, who, according to Ashmole, is corroborated by the statutes of the Order says 1350. The precise cause of the origin or formation of the Order is likewise not distinctly known. The common story respecting the fall of the Countess of Salisbury's garter at a ball, which was picked up by the king, and his retort to those who smiled at the action, *Honi soit qui mal y pense*, which afterwards became the motto of the order, is not entirely given up as fable. A tradition certainly obtained as far back as the time of Henry VI. that this Order received its origin from the fair sex. Ashmole's opinion was, that the Garter was selected at once as a symbol of union and a compliment to the ladies.

This Order was founded in honour of the Holy Trinity, the Virgin Mary, St. George, and St. Edward the Confessor. St. George, who had become the tutelary saint of England, was considered as its especial patron and protector. It was originally composed of twenty-five knights, and the sovereign (who nominates the other knights), twenty-six in all. This number received no alteration till the reign of George III., when it was directed that princes of the royal family and illustrious foreigners on whom the honour might be conferred should not be included. The number of these extra-knights was fourteen in 1834. The military knights of Windsor are also considered as an adjunct of the Order of the Garter.

The officers of the Order are a prelate, who is always the bishop of Winchester: a chancellor, who till 1837 was the bishop of Salisbury, but is now the bishop of Oxford, in consequence of Berkshire, and of course Windsor, being transferred to that diocese; a registrar, who is the dean of Windsor; garter principal king-at-arms of the Order; and a gentleman usher of the black rod. The chapter ought to meet every year on St. George's day (April 23rd), in St. George's chapel, Windsor, where the installations of the Order are held, and in which the banners of the several knights are suspended.

The original dress of the Knights of the Garter was a mantle, tunic, and capuchin or hood, of the fashion of the time, all of blue cloth; those of the knights companions differing only from the sovereign's by the tunic being lined with miniver instead of ermine. All the three garments were embroidered with garters of blue and gold, the mantle having one larger than all the rest on the left shoulder. The dress underwent various changes. Henry VIII. remodelled both it and the statutes of the Order, and gave the knights the collar, and the greater and lesser George, as at present worn. The last alteration in the dress took place in the reign of Charles II.: the principal parts of it consist of a mantle of dark blue velvet, with a hood of crimson velvet; a cap or hat with an ostrich and heron plume; the stockings are of white silk, and the garter, which is of dark blue velvet, having the motto embroidered in gold letters, is worn under the left knee. The badge is a gold medallion representing St. George and the dragon, which is worn suspended by a blue ribbon; hence it is a form of speech to say, when an individual has been appointed a knight of the garter, that he has received the blue ribbon. There is also a star worn on the left breast. The fashion of wearing the blue ribbon suspended from the left shoulder was adopted in the latter part of the reign of Charles II.

It is not generally known, that from the first institution of the Order of the Garter to at least as late as the reign of Edward IV., ladies were admitted to a participation in the honours of the fraternity. The queen, some of the knights-companions' wives, and other great ladies, had robes and hoods of the gift of the sovereign, the former garnished with little embroidered garters. The ensign of the garter was also delivered to them, and they were expressly termed *Dames de la fraternité de St. George*. The splendid appearance of Queen Philippa at the first grand feast of the Order is noticed by Froissart. Two monuments also are still existing which bear figures of ladies wearing the garter: the Duchess of Suffolk's, at Ewelme, in Oxfordshire, of the time of Henry VI., represents her wearing it on the wrist, in the manner of a bracelet; Lady Harcourt, at Stanton Harcourt, in Oxfordshire, of the time of Edward IV., wears the garter on her left arm.

Ashmole, writing on the habit and ensigns of the Order (*Hist. of the Order of the Garter*, fol. Lond. 1672, p. 218), says, 'After a long disuse of these robes by the queens of England and knights-companions' ladies, there was at the feast of St. George, celebrated an. 14 Cha. I., endeavour used to have them restored; for the then deputy-chancellor moved the sovereign in chapter (held the 22nd May), that the ladies of the knights-companions might have the privilege to wear a garter of the Order about their arms, and an upper robe, at festival times, according to ancient usage. Upon which motion the sovereign gave order that the queen should be acquainted therewith and her pleasure known, and the affair left to the ladies' particular suit. The 10th of October in the following year (1639), the feast of St. George being then also kept at Windsor, the deputy-chancellor reported to the sovereign in chapter the answer which the queen was pleased to give him to the aforesaid order, whereupon it was then left to a chapter to be called by the knights-companions to consider of every circumstance, how it were fittest to be done for the honour of the Order, which was appointed to be held at London about Alhollantide after; but what was then or after done doth not appear; and the unhappy war coming on, this matter wholly slept.'

When Queen Anne attended the thanksgiving at St. Paul's in 1702, and again in 1704, she wore the garter set with diamonds, as sovereign of the Order, tied round her left arm.

GARTH, SAMUEL, eminent as a physician and a wit, during the reigns of William III. and Anne, was descended of a good Yorkshire family, received his academical education at Peterhouse, Cambridge, and graduated as M.D. in 1691. Having settled in London, he rendered himself distinguished by his conversational powers, which recommended and set off his professional skill, and soon acquired

very extensive practice. Being a zealous Whig, he became intimate with the wits and great men of the Whig party. At the accession of the House of Hanover, he obtained his reward in the honour of knighthood, and in the offices of physician and ordinary to George I., and physician-general to the army. He died January 18, 1718.

Garth is known in our literary history as the author of a mock-heroic poem called 'The Dispensary.' It arose out of a quarrel between the College of Physicians and the Corporation of Apothecaries, concerning the establishment of a (then) new charity, for the gratuitous distribution of advice and medicine to the poor. To this the apothecaries strongly objected, as being injurious to their business. Garth, a strong supporter of the dispensary, wrote his poem to satirise its opponents, and recommend the scheme to the public. It is written with a competent share of spirit and elegance, and obtained popularity. But the introduction of the supernatural machinery of the antient epic, and the imitation of Homer's battle-scenes, are so extravagant and incongruous when pressed into the account of a medical squabble of the seventeenth century, that a poem of near 2000 lines, of which they form the staple, could not be expected to keep its ground when the temporary interest of its subject passed away. Accordingly it has long ceased to find readers. Garth's other original poems consist of occasional pieces, prologues, epilogues, and the like. He superintended a translation of Ovid's 'Metamorphoses,' by various hands; among whom were an unusual number of eminent men. Dryden contributed the first, twelfth, and many portions of other books. Addison, the second and third. Gay, Pope, Congreve, Rowe, and other less distinguished men were also concerned. Garth himself contributed the fourteenth, and part of the fifteenth book, with a critical preface, slightingly noticed by Dr. Johnson. (*Lives of the Poets: Prefaces, Dispensary*, and *Ovid; Biogr. Brit.*)

GARVE, CHRISTIAN, was born at Breslau in the year 1742. At an early age he lost his father, and he was indebted for his education to the solicitude of his mother. He attended the gymnasium at Breslau, and was designed for the church, which however, on account of the delicate state of his health, he never entered. In 1760 he attended the high school at Halle for the purpose of studying mathematics and philosophy, which studies he continued to pursue at the university of Leipzig, when Gellert, Weisse, and others were his friends. He returned to his mother's house at Breslau in 1767, and studied so hard as to injure his naturally weak constitution, and to bring on a hypochondriacal temperament. On the death of Gellert in 1769, Garve was called to Leipzig to fill the vacant professorship, and he read lectures on pure mathematics and logic as long as his declining health would allow, till at last he was obliged to resign his office and return to his native town, where he was a private teacher for nearly the remainder of his life. A translation of Burke 'On the Sublime and Beautiful,' and of other English works, first made him known to the literary world; and his 'Philosophical Treatises' (*Philosophische Abhandlungen*), published in 1779, gained him such reputation that Frederick the Great invited him to Charlottenburg and treated him with marked respect. At the suggestion of the king he published an edition of Cicero's 'Offices,' which appeared in 1783, and went through four editions. Garve's last years were passed in great misery. He bore his sufferings with the most exemplary fortitude, and died in 1798.

Garve is one of those writers who were called philosophers before German philosophy had assumed that peculiar character which it bears at present. His treatises are in a popular style, and are on subjects of general and practical interest, such as 'patience under calamity,' 'the advantages of a moral life,' and so on. The last century abounded with writers of this description, many of whom were little more than verbose enunciators of common-places. But Garve was not of this class. Though he does not discuss abstruse matters, nor leave the sphere of practical usefulness, he often considers his subjects in a new light, and starts points which would never have struck an ordinary mind. In one instance he mentions the much-decried Spinoza with tolerable respect, which shows him to have been above the prejudices of a time when it was fashionable to speak of this philosopher in terms of the greatest abhorrence without knowing any one of his opinions. Garve translated the 'Politik,' 'Ethics,' and 'Rhetoric' of Aristotle into German; these translations, though not without their merits, by no means present a faithful counterpart of the originals.

GAS, a term employed by chemists as synonymous with air. It was first used in a very general sense by Van Helmont; but in consequence of the great number of permanently-elastic fluids discovered by Priestley, so different in their properties from common air, and in order to avoid any confusion from the use of the same word to express both, Macquer employed the term gas, which has been universally adopted to distinguish from mere vapours all such elastic fluids as had not been rendered liquid or solid by reducing their temperature.

The experiments of Professor Faraday have however shown that elastic fluids are included in this definition, which may be liquefied by reducing the temperature and increasing the pressure. Still however there exists this difference between bodies in the elastic state: - vapours generated by the agency of heat are reduced to solids or liquids when the heat is withdrawn; while gases preserve their aëriform state at common temperatures. It must however be admitted that the difference is one of degree only, and though not an essential one, it is usefully retained.

Every gas consists of the ponderable matter from which its name is derived, combined with that degree of specific heat which is necessary to its aëriform existence.

The number of gaseous bodies is great, and they possess in many respects such different properties, that it would be impossible to give a general description of them. The qualities therefore peculiar to each gas will be stated under its proper head: thus it will appear that some gases are elementary or simple in their nature, while by far the greater number are compound bodies; few of them exist in nature, but are mostly the products of chemical agency. Gases differ as to colour, odour, taste, specific gravity, and solubility in water; they vary also in their effects upon the animal economy, and in their relations to heat: most of them are either combustible or supporters of combustion, but one important gas at least belongs to neither class. Their powers of chemical combination are also extremely different; one gas only possesses alkaline properties, whilst there are several gaseous acids.

One most important circumstance relative to gaseous bodies has been much discussed, and very opposite conclusions have been arrived at respecting it by philosophers of eminence: it is this, whether all gases, under the same volume and pressure, have the same specific heat. That this is the case, has been maintained by Haycraft, and Marcet and Delarive, and some others; while Dalton, Delaroche and Berard, Dulong and Dr. Apjohn, &c., are of opinion that equal volumes of different gases have not the same specific heat under similar circumstances.

It would be useless to detail the processes or to describe the apparatus by which chemists have arrived at such discordant results. The experiments of Delaroche and Berard, which are in general most relied upon, though complicated, were made with great care: they transmitted known quantities of gas, heated to 212° in a uniform current, through a calorimeter, the serpentine of which was surrounded with water, the temperature of which, as well as of the gas at its exit, being ascertained during the course of the process by very delicate thermometers. These chemists operated with a considerable quantity of gas, and used other precautions to avoid the errors into which other experimentalists had fallen.

The following is a statement of the results obtained by Dalaroche and Berard, Dulong, and Dr. Apjohn, of the specific heats of equal volumes of the gases mentioned, under equal pressures:—

	Delaroche and Berard.	Dulong.	Apjohn.
Atmospheric air . .	1·000	1·000	1·000
Azote	1·000	1·000	1·048
Oxygen	·976	1·000	·808
Hydrogen . . .	·903	1·300	1·459
Carbonic acid . .	1·258	1·172	1·195
Carbonic oxide . .	1·034	1·000	·996
Nitrous oxide . .	1·350	1·159	1·193

Dr. Apjohn observes that the numbers which he has arrived at correspond tolerably well with those of Delaroche and Berard, except in the case of hydrogen; and he admits that he does not speak with much confidence of the numbers attached to azote and oxygen.

There are some other properties which gases possess in common, though they vary in degree. There is however one circumstance in which they all agree, whether they are elementary or compound, and whatever may be the difference of their specific gravity:—they are subject to suffer the same increase of volume, when subjected to the same increase of temperature.

According to Dalton, when 100 volumes of air are heated from 32° to 212°, they become 132·5 volumes; by Gay-Lussac's experiments they increase to 137·5 volumes; by Crichton's to 137·48: the expansion therefore of each volume, according to Dalton is $\frac{1}{556}$, to Gay-Lussac $\frac{1}{480}$, and to Crichton $\frac{1}{480 \cdot 23}$, for one degree of Fahrenheit's thermometer.

The discovery of this law has supplied chemists with a simple rule for determining what the known bulk of a gas at any temperature will be at any other temperature. Suppose, for example, it is desired to know what the bulk of 100 cubic inches of air at 32° will be at 60°: subtract 32 from 480, the remainder is 448; to which add the degrees above zero indicating the temperature of the air, these are 32° and 60°, making 480 and 508. Then say 480 : 508 : : 100 : 105·832, the volume of the air at 60°.

It is well known that air suffers diminution of volume in proportion to the pressure to which it is subjected, and the same law holds good with all the more incondensible gases. In chemical analyses it is often requisite to make corrections for variations of barometric pressure, as well as of temperature in estimating the quantity of gaseous products. The following are the rules for this purpose, given by Professor Faraday in his work on Chemical Manipulation :—'A pressure of 30 inches of mercury, as observed by an accurate barometer, has been assumed as the *mean height* or *barometric pressure*, and volumes of gas observed at any other pressure frequently require to be corrected to what they would be at this point. For this purpose it is only necessary to compare the observed height with the mean height, or 30 inches, and increase or diminish the observed volume inversely in the same proportion. Thus, as the mean height of the barometer is to the observed height, so is the observed volume to the volume required. As an instance, suppose that 100 cubic inches of gas have been observed when the barometer stood at 30·7 inches: then, as 30 inches, or mean height, is to 30·7 inches, or observed height, so is 100, or the observed volume to a fourth proportional, obtained by multiplying the second and third terms, and dividing by the first: thus, 30·7 × 100 = 3070, which divided by 30 = 102·333 cubic inches; this would be the volume of the gas at 30 inches of barometric pressure. Again, suppose a quantity of gas amounting to 20 cubic inches standing over mercury in a jar, the level of the metal within being 3 inches above that without, and the barometer at 29·4 inches. Then the column of 3 inches mercury within the jar, counterbalancing 3 inches of barometric pressure, instead of being 29·4, the latter is effectively only 26·4, and the correction will be, as 30 inches is to 26·4 inches, so is the 20 cubic inches observed to 17·6 cubic inches, the volume which the gas would really occupy if the mercury were level within and without the jar, and the barometer were 30 inches.'

It is very commonly requisite to make corrections both for temperature and pressure in the same volume of gas, and it is of no consequence which is made first.

In chemical analyses various other considerations arise in ascertaining the quantities of gaseous products; as for example, the separation of or making the requisite allowances for the moisture which they contain: for these, as well as for the various modes of collecting, transferring, and preserving various gases, we must refer to the very excellent work just quoted.

The solubility of gases in water is extremely various. Dr. Henry ascertained that the volume of each gas absorbed by water is the same, whatever be the pressure to which the gas is previously subjected. If the weight of carbonic acid gas be doubled by subjecting it to the pressure of two atmospheres, water will still absorb its own volume of it. The following table exhibits the volumes of each gas absorbed by 100 volumes of water, supposing the temperature and pressure to be the same in all cases:—

	Absorption in Volumes.	Authority.
Cyanogen	450	Gay-Lussac
Sulphuretted hydrogen	366·6	Thomson
Chlorine	200	Berthollet
Carbonic acid	106	Cavendish
Nitrous oxide	76	Saussure
Olefiant gas	15·3	Saussure
Phosphuretted hydrogen	5	Thomson
Nitric oxide	3·7	Dalton
Oxygen	3·7	Henry
Carburetted hydrogen	3·7	Dalton
Azote	2·5	Dalton
Carbonic oxide	2·01	Henry
Hydrogen	2	Dalton

It may be observed, that in general the more easily a gas is condensable by cold and pressure, the more soluble it is in water: this will appear by comparing the above statements with that containing the pressure at which Faraday liquefied various gases.

A curious property of gases, and possessed by them in very different degrees, is that of their condensation by porous bodies, and especially by charcoal. According to Saussure, one volume of charcoal, made red-hot, cooled under mercury, and exposed to the under-mentioned gases, absorbed the volumes annexed; the absorption was completed in twenty-four hours, and when the charcoal which had been saturated with one gas was removed to another, a portion of the first was expelled, and replaced by a portion of the second:—

Ammonia	90	Olefiant gas	35
Hydrochloric acid	85	Oxide of carbon	9·42
Sulphurous acid	65	Oxygen	9·25
Hydrosulphuric acid	55	Azote	7·50
Nitrous oxide	40	Carburetted hydrogen	5
Carbonic acid	35	Hydrogen	1·75

It is extremely probable that different kinds of charcoal absorb different portions of the same gas; for it was found by Messrs. Allen and Pepys, that they absorbed very different quantities, chiefly of moisture, by exposure to the air.

A curious fact with respect to mixtures of gases was discovered by Dr. Priestley, which he thus states:—'Different kinds of air that have no affinity do not, when mixed together, separate spontaneously, but continue diffused through each other.' This he proved to be the case by several experiments; and more especially by one, in which he found that he was able to explode hydrogen and oxygen gases, which had long remained together, and which he justly argues must have been mixed, or he could not have fired them by an electric spark, in a vessel, the wires of which were at the top. He adduces this experiment to illustrate the fact that the gases which constitute the atmosphere do not separate according to their respective gravities, though they do not combine. (Priestley's *Experiments*, &c., vol. vi. p. 391.)

These experiments were repeated by Dr. Dalton, and he inferred from them that the particles of one gas, though repulsive to each other, do not repel those of a different kind; and that one gas acts as a vacuum with respect to another. If therefore a vessel full of carbonic acid be made to communicate with another of hydrogen, the particles of each gas insinuate themselves between the particles of each other till they are equally diffused through both vessels. This theory accounts not only for the mixture of gases, but for the equable diffusion of vapours through gases and through each other.

Another observation made by Dr. Priestley, and related with others of a similar kind (*American Phil. Trans.* vol. v.), appears to have been entirely overlooked. He found that though a glass vessel was perfectly air-tight, yet if it had been broken, and the pieces joined with paint or cement, hydrogen gas contained in it would be changed for the external air. Döbereiner has since remarked the escape of hydrogen gas by a fissure or crack in glass receivers. Professor Graham, in an elaborate paper on this subject, has shown that gases diffuse into atmospheric air and into each other, with different degrees of ease and rapidity, the lighter ones escaping most readily, so much indeed, that hydrogen escapes five times more quickly than carbonic acid gas, which is about 22 times heavier.

To Dr. Priestley also we are indebted for the important discovery that gases can pass through membranes which are perfectly air-tight, and by this action he explained that of the atmosphere upon the blood in the lungs. In the memoir above alluded to he has also shown, that when a bladder containing hydrogen is put into a vessel of oxygen,

or one with oxygen into a vessel of hydrogen, the bladder and the vessel of gas both contain both gases, owing to the passage of the gases from and into the bladder. It is also stated by Professor Graham, that if a bladder, half filled with air, with its mouth tied, be passed up into a large jar filled with carbonic acid gas, standing over water, the bladder, in the course of twenty-four hours, becomes greatly distended by the insinuation of the carbonic acid through its substance, and may even burst, while a very little air escapes outwards from the bladder. This however he does not consider as a case of simple diffusion; the result depends, first, upon carbonic acid being a gas easily liquefied by the water in the substance of the membrane, and therefore the carbonic acid penetrates the membrane as a liquid; secondly, this liquid is in the highest degree volatile, and therefore evaporates very readily from the inner surface of the bladder into the air confined in it. The air in the bladder comes to be expanded in the same manner as if æther or any other volatile fluid was admitted into it. Professor Graham further observes, that in the experiments of Dr. Mitchell and Faust and others, in which gases passed through a sheet of caoutchouc, it is to be supposed that the gases were always liquefied in that substance, and penetrates through it in a fluid form; and it is also to be noticed, that it is always those gases which are more easily liquefied by cold or pressure that pass most readily through both caoutchouc and humid membranes.

Dr. Mitchell found that the time required for the passage of equal volumes of different gases through the same membrane was—

1	minute	with	ammonia.
2½	minutes	with	hydrosulphuric acid.
3½	„	„	cyanogen.
5½	„	„	carbonic acid.
6½	„	„	nitrous oxide.
27½	„	„	arseniuretted hydrogen.
28	„	„	olefiant gas.
37½	„	„	hydrogen.
113	„	„	oxygen.
160	„	„	carbonic oxide.
And with a much longer time		. .	azote.

It has been already observed, that the original definition of the term *gas* required modification on account of the condensation and liquefaction of some elastic fluids, by Professor Faraday, which had resisted all previous attempts. He subjected numerous gases to experiment, in order to determine how many of them could be rendered fluid by the combined agency of cold and pressure; and he succeeded with those which we shall presently enumerate: among them it may be remarked that chlorine is the only elementary gas which was liquefied. The ingredients for producing the gases to be operated upon were put into a strong glass tube, which was then hermetically sealed and slightly bent in the middle, so that one portion of the tube might serve as a retort and the other as a receiver. When requisite, the gas was generated by heat; and when the pressure of the atmosphere of gas formed was sufficiently great, the liquid formed and collected in the recipient end of the tube, which was kept cool to accelerate the condensation.

The following of the results obtained by Professor Faraday will show the different temperatures and pressures required to liquefy those gases which were condensed:—

Sulphurous acid gas . .	2	atmospheres	at	45°	Fahr.
Cyanogen gas	3·6	„	„	45	„
Chlorine gas	4·	„	„	60	„
Ammoniacal gas . . .	6·5	„	„	50	„
Hydrosulphuric acid gas	17·	„	„	50	„
Carbonic acid gas . .	36·	„	„	32	„
Hydrochloric acid gas .	40·	„	„	50	„
Nitrous oxide gas . . .	50·	„	„	45	„

No one of these gases was solidified, but within a short time Thilorier has succeeded in solidifying carbonic acid gas. He found that when the liquid acid was dropped, that owing to the conversion of one portion suddenly into gas, the remainder was so much cooled as to solidify.

It is to be observed, that although cold and pressure, as far as they have hitherto been tried, are incapable even of liquefying many of the gases, yet they may easily be even solidified by combination with each other in many cases, or by union with solid bodies.

Thus oxygen and hydrogen, which have never been separately even liquefied, form water by combination, which, as is well known, is rendered solid by a moderate reduction of temperature. Hydrogen and azote form ammoniacal gas, and hydrogen and chlorine constitute hydrochloric acid gas; these two compound gases combine without the application either of cold or pressure, and immediately form the well-known solid hydrochlorate of ammonia; yet it may be noticed that chlorine is the only one, of the three elementary gases which enter into the composition of the solid, that has ever been liquefied.

These remarks would admit of great extension, but they are sufficient to establish points for which they are adduced.

In concluding we may observe that gaseous bodies are of the highest importance in every possible respect, as connected not merely with the well-being, but as absolutely necessary to the existence of animals: two of them, oxygen and azote, form our atmosphere; two of them, hydrogen and oxygen, constitute water; oxygen united with various metals forms the greater part of the crust of our globe; and chlorine is one of the elements of common salt.

GAS LIGHTING.—*History*.—When coal, oil, wax, wood, or any other organic inflammable substance is exposed to destructive distillation in closed vessels, an inflammable gas is the result. This gas is some compound of hydrogen and carbon. The experiments of Dr. Henry show that those substances which give most light in burning, produce the most brilliantly illuminating gas when distilled. The following list, giving the proportion of oxygen required to consume a hundred measures of each gas, results from the experiments of Dr. Henry, who considers that the illuminating power of each is proportionate to the quantity of oxygen required to consume it:—

100 measures	of	hydrogen require	50	meas.	of oxygen.
„	„	dried peat gas	68	„	„
„	„	oak wood gas	54	„	„
„	„	cannel coal gas	170	„	„
„	„	lamp oil gas	190	„	„
„	„	wax gas	220	„	„
„	„	pure olefiant gas	284	„	„

The chemical nature of these gases is treated under HYDROGEN; our business at present is with coal gas as used for artificial light, and incidently with such other gases as have been employed or proposed for the same object.

The existence and inflammability of coal gas have been known for nearly 200 years. In the year 1659, Thomas Shirley correctly attributed the exhalations from the burning well of Wigan in Lancashire to the coal-beds which lie under that part of the county; and soon after Dr. Clayton, influenced by the reasoning of Shirley, actually made coal gas, and detailed the results of his labours in a letter to the Hon. Robert Boyle, who died in the year 1691. He says he distilled coal in a retort, and that the products were phlegm, black oil, and a spirit which he was unable to condense, but which he confined in a bladder. These are precisely what we now find, but under different names; the phlegm is water, the black oil is coal tar, and the spirit is gas. Dr. Clayton several times repeated the experiment, and frequently amused his friends with burning the gas as it came from the bladder through holes made in it with a pin. This was a hint which, in an age more alive to economic improvement, might have brought gas-lighting into operation a century earlier; though the mechanical difficulties might have been too great to overcome at that period; a circumstance which has retarded the introduction of many valuable discoveries, as it did that of the steam-boat and the printing-machine.

In the year 1733 Sir James Lowther communicated to the Royal Society a curious notice of a spontaneous evolution of gas at a colliery belonging to him near Whitehaven. While his men were at work, they were surprised by a rush of air, which caught fire at the approach of a candle, and burned with a flame two yards high and one yard in diameter; they were much frightened, but put the flame out by flapping it with their hats, and then all ran away. The steward of the works hearing this went down himself, lighted the air again, which had now increased, and had some difficulty in extinguishing it. It was found to annoy the workmen so much, that a tube was made to carry it off The tube projected four yards above the pit, and at the extremity of it the gas rushed out with much force. ' The gas

being fired,' says the account, 'it has now been burning two years and nine months, without any sign of decrease.' Large bladders were filled in a few seconds from the end of the tube, and carried away by persons, who fitted little pipes to them and burned the gas at their own convenience. We do not learn what became of this copious supply; it probably diminished as the coal-bed was exhausted.

Soon after the middle of the last century Dr. Watson made many experiments on coal gas, which he details in his 'Chemical Essays:' he distilled the coal, passed the gas through water, conveyed it through pipes from one place to another, and did so much that we are only surprised he did not introduce it into general use.

But although the properties of coal gas were known to so many persons, no one thought of applying it to a useful object until the year 1792, when Mr. Murdoch, an engineer, residing at Redruth in Cornwall, erected a little gasometer and apparatus, which produced gas enough to light his own house and offices. Mr. Murdoch appears to have had no imitators, but he was not discouraged, and in 1797 he erected a similar apparatus in Ayrshire, where he then resided. In the following year he was engaged to put up a gas-work at the manufactory of Boulton and Watt, at Soho. This was the first application of gas in the large way: but, excepting in manufactories or among scientific men, it excited little attention until the year 1802, when the front of the great Soho manufactory was brilliantly illuminated with it on the occasion of the public rejoicings at the peace. Accustomed as we are to the common use of gas, we cannot even now but be struck with such a display on a large scale: but the superiority of the new light over the dingy oil lamps used at that day, when thus brought into public view, produced an astonishing effect. All Birmingham poured forth to view the spectacle, and strangers carried to every part of the country an account of what they had seen. It was spread about everywhere by the newspapers, easy modes of making gas were described, and coal was distilled in tobacco-pipes at the fire-side all over the kingdom. Soon after this several manufacturers, whose works required light and heat, adopted the use of gas: a button manufactory at Birmingham used it largely for soldering: Halifax, Manchester, and other towns followed. A single cotton-mill in Manchester used above 900 burners, and had several miles of pipe laid down to supply them: the quantity made averaged 1250 cubic feet per hour, producing a light equal to that of 2500 candles. Mr. Murdoch, who erected the apparatus used in this mill, sent a detailed account of his operations to the Royal Society in 1808, for which he received their gold medal.

But although the use of gas was thus spreading in the manufacturing towns, it made little progress in London. This may be accounted for, in some measure, by the circumstance that no means had as yet been found out for purifying it. It was dirty, it had a disagreeable smell, and it caused headache when used in close rooms, besides spoiling delicate furniture. This was of little consequence in a manufactory, where there is generally ventilation enough to carry off unpleasant vapours, and rarely very delicate organs or fine furniture to suffer from their influence. But these defects were fatal to its general introduction in London, and until they could be removed there was small hope of success; though attempts were made, lectures delivered, and a number of interesting experiments made by a German named Winsor, whose perseverance and sanguine temper were very efficient in making the matter known to the public. But Winsor was deficient in chemical knowledge and mechanical skill, while he largely overrated the powers of the new instrument which he was zealously endeavouring to introduce. He took out a patent in 1804; and issued a flaming prospectus of a National Light and Heat Company, promising to subscribers of 5*l.* a fortune of at least 570*l.* per annum, with a prospect of ten times as much. A subscription was soon raised, it is said, of 50,000*l.* which was all expended in experiments without profit to the subscribers. Winsor however gained experience, and is said, we know not how truly, to have introduced the important measure of purifying gas by lime. In 1807 he lighted up Pall Mall, which continued for some years to be the only street in London in which gas was used. In 1809 the National Light and Heat Company applied to Parliament for a charter, but they were opposed by Mr. Murdoch on the score of prior discovery, and the charter was refused. It was however granted on a subsequent application, and the operations of the company became more extensive. But their profits had not yet begun, and increase of business was only increase of expense. The subscribers began to be alarmed at the exhaustion of their funds, and called loudly for a change in the management of their affairs. This was conceded, and the superintendence of their works was entrusted to Mr. Clegg, who had been for some years engaged in the erection of gas apparatus in Birmingham. Affairs now began to wear a better face; other parts of London applied for light, and new stations were erected. The business of the company steadily increased, and in the year 1823, in the course of a parliamentary investigation, it was shown that this company alone consumed annually 20,678 chaldrons of coals, which produced on an average 680,000 cubic feet of gas every night; this was distributed by means of 122 miles of pipe, which supplied more than 30,000 burners, giving a light equal to as many pounds of tallow candles. The other companies then established made altogether about the same quantity; and such has been the increase of gas-lighting since that time, that at one of their stations only, the chartered company are now making 1,200,000 cubic feet every twenty-four hours, and average about a million all the year round. We believe it may be asserted, that every street and alley in London is now lighted with gas, and the consumption of the metropolis may be stated at eight millions and a half of cubic feet every twenty-four hours.

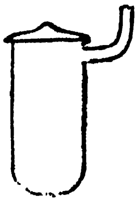
The great success which attended gas-light in London has extended itself throughout Great Britain. Every large town has long had gas; the smaller towns have followed, and there is now scarcely a place in the kingdom without it. The continental nations have slowly followed our example; Paris for some years, and more recently the towns of Lyon, Marseille, Bordeaux, Nantes, Caen, Boulogne, Amiens, and several others, have adopted it. It is in use in many parts of Germany and Belgium, and St. Petersburg has a small establishment, which is rapidly increasing under the superintendence of a gentleman from one of th London works. The larger towns in the United State also burn gas: and even in the remote colony of New South Wales, the town of Sydney has introduced this valuable invention, which we have no doubt will be found there, as it has been in London, as useful in preventing nocturnal outrage as an army of watchmen.

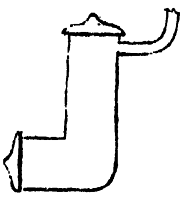
It will not be necessary to say much about oil gas: the light it produces is, it is true, much greater than that given out by an equal quantity of coal gas; but although it was introduced with success in some places where coal was dear, it has always yielded to coal wherever the two came into competition. The process of manufacture is exceedingly simple, and the machinery is much cheaper. But the cost of the oil itself is the great objection, and we fear it will be found insuperable. Oil gas was for some time rendered portable: it was forced into strong vessels with a power equal to 450 lbs. upon the square inch, and, thus confined, could be carried about and placed upon a table. As each vessel contained about thirty times as much compressed gas as it would hold in its natural state, one of the capacity of a quarter of a foot would give light for several hours But even such a size as this was very clumsy, and the process seems to be declining.

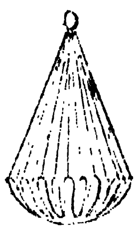
Some other substances have been proposed for gas-making, such as rosin, wood, and peat. Rosin has been tried at more than one establishment, but it has not been found to produce a gas much better than coal gas, while the cost is much greater. An American, some years ago, took out a patent for making gas from cotton seeds, which are, it appears, of very little value in America; but whether or not he has reaped any advantage from the suggestion, we are not informed. The superior cheapness of coal, in those places where it can be procured, will probably always put it above any other material that could be proposed for the manufacture of gas.

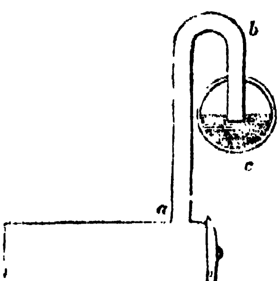
Manufacture.—Although in the large way there are many practical difficulties to be surmounted in the manufacture of coal gas, the operation is easily understood; it is merely a process of distillation. A quantity of coal is put into a retort, which is well closed, and placed upon the fire; the temperature is raised to redness, which decomposes the coal, and drives the gas resulting from the decomposition through a pipe leading from the retort to the receptacle prepared for it. A mass of coke remains, of greater bulk, though less weight, than the coal first put in. This coke must be taken

out, and replaced by a fresh supply of coal, and the process is to be repeated as often as may be requisite. Such is the theory of gas-making; the manner of putting it to practice remains to be described. The first part of the apparatus is the retort, which is made of cast-iron; the shape of this vessel has been somewhat altered from that which it first had. The original form is shown in this figure; it held about 15 lbs., and was placed in an upright position for the convenience of throwing in the coals; it was found to answer perfectly well; and so far as making gas is concerned, it could not be much improved. But the removal of the coke after the gas was made was found to be troublesome. Different means were devised to remedy the defect, one of which was to have an aperture near the bottom of the retort, at which the coke might be raked out, in addition to the one at the top where the coal was put in, as in this figure. This remedied the defect; but the trouble of stopping the retort, which is a work of some time, was thus doubled, and the probability of an escape of gas was much increased: the plan was consequently abandoned. Afterwards a much larger retort was adopted, shaped as the first, but holding about fifteen hundred-weight of coal, which would of course require feeding but rarely, and was emptied by a sort of grated iron or basket, called a grappler, suspended by chains. The grappler was put into the retort when empty, and was drawn out by a crane when the distillation was over. It was found however that the heat of the fire would not readily penetrate to the interior of such a large mass of coal; the outer portion formed a cake of nonconducting matter which protected the remaining coal, and caused the expenditure of much fuel. The gas was injured in its illuminating power by being formed so slowly, being deprived of its bituminous admixture by the continued heat. It was consequently found expedient to revert after all to the smaller-sized retort, and to lessen the inconvenience of taking out the coke it was placed in an horizontal position; the difficulty of filling a retort in this position was obviated by the use of a scoop or semicylindrical shovel long enough to reach to the end of it. This form of retort, which is still in common use, differs in different establishments only as one is a little larger or smaller than another, or more or less flattened, so as to expose a larger surface to the fire than would be the case with a true cylinder. The retorts are placed in ovens, in groups of three, five, seven, or more, according to the size of the establishments; and their mouths, where the coal is put in, stand out in front of the ovens. Just behind the mouth of the retort a pipe *a* leads from it perpendicularly upwards several feet; then taking a sudden turn, *b*, it descends again about a yard, and enters a much larger pipe *c*, technically called the hydraulic main, which runs through the whole building, and receives the gas produced from all the retorts. This great main is generally about half full of the tar and water which leave the coal with the heated gas, and rise with it in the state of vapour, but are condensed by the coldness of the main. Into this mixture the end of the pipe dips, and is thus closed against a return of gas, which would take place if the supply should slacken. A section of the ascending pipe and hydraulic main half full of liquid is shown in the figure.

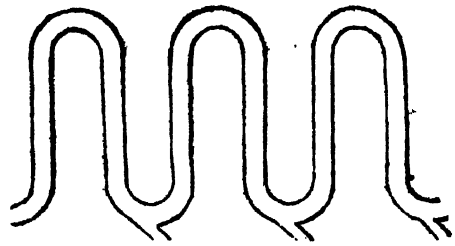






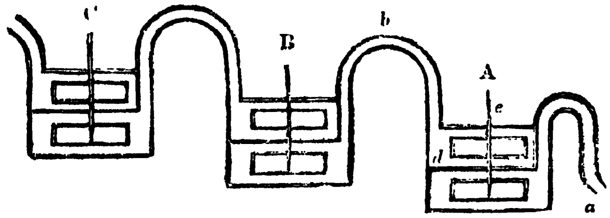


The gas is now made; but it is very impure, being mixed with water, tar, sulphuretted hydrogen gas, and other impurities. The tar and water are easily got rid of, little more being required for this purpose than to cool the gas and to allow the deposit to run off. This is effected by forcing it through a tube which is bent, as in the figure,



and which is kept cool by being immersed in cold water; or still better, as lately adopted in the principal establishment in London, by allowing cold water to drop upon it this last method has been found to lower the temperature from 20 to 25 degrees more than the old way.

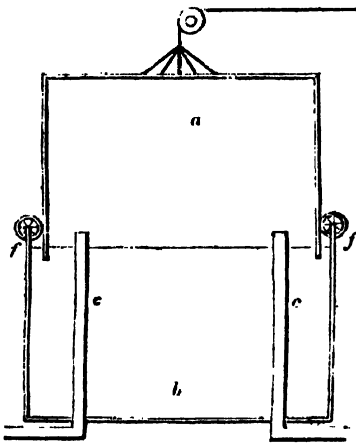
The separation of the sulphuretted hydrogen gas is a much more troublesome process: it cannot be got away by any washing or cooling, but passes through these processes without change. Worse than the other impurities mentioned, which are only offensive from dirt, this gas is a poison; in any considerable quantity it proves fatal, and is always very unwholesome. It can only be separated by some substance for which it has a chemical attraction, but which has no influence on coal gas. Such a substance is lime. Lime was suggested as a purifier by Dr. Henry, of Manchester, as early as the year 1808, though it was not used on a large scale until some years later; while a variety of inefficacious plans, such as passing the gas through hot iron tubes, and washing it with water, were often tried. The lime is used by being mixed up with water into a thin pasty mass, which the workmen call cream. The cream is placed in a cylindrical vessel, and is constantly stirred by an instrument called an agitator, which is an upright shaft with large flat pieces of wood or metal standing out perpendicularly from it, not unlike a chocolate-mill: the agitator is kept constantly revolving on its shaft, while the flat leaves pass through the whole mass of cream, keeping it well mixed. The gas as it comes from the condenser passes into the lime, and comes from it partially purified: it then enters another purifier, made and furnished precisely in a similar way: after that another: and often a fourth in large works. When it leaves the last vessel it may be considered pure. The accompanying figure will give an idea of the



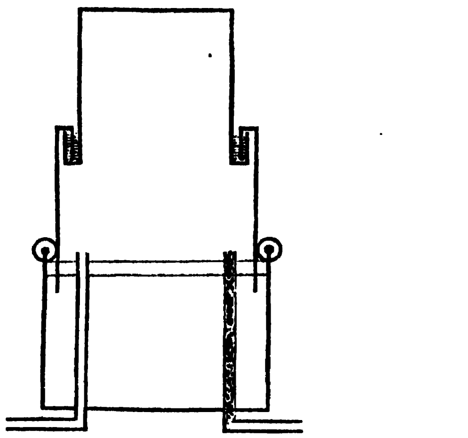
manner of arranging the purifiers. They are not all upon the same level; but the one marked C is higher than the middle one, marked B, and the lowest is A. This arrangement is made in order that the filling of the vessels may be accomplished with as little labour as practicable. The lime is mixed with water in a vessel placed above C, into which it descends by a pipe not in the figure; from C it is taken to B, and from B to A. The gas goes in the opposite direction: it enters the vessel A by the tube *a*, and is conveyed under the partition *d*, through which it passes by little holes into the upper division; it then passes through *b* into B, and then to C, from whence it comes out pure. The agitator is marked *e*. It will be understood that by this arrangement the fresh-made gas first meets a mixture which is deteriorated by having already purified a portion of gas in the higher vessels; it goes from that vessel into one filled with a more active agent; and then, almost pure, it goes into a mixture fresh from the reservoir, if there are but three purifiers in the set; but if there are four, it passes into a third before arriving at that one which contains the fresh mixture. In order to know whether or not the gas be pure, it is tested by a solution of acetate of lead, which is a colourless liquid. It is a property of sulphuretted hydrogen gas to produce a brown precipitate with any salt of lead; if therefore any of this gas be mixed with the coal gas which is placed in contact with the colourless solution, it will show itself by turning the liquid brown. The most usual way of testing is to open a stop-cock fixed for that purpose in some part of the pipe which leads the gas into

the last purifying vessel, and to put a card dipped in the solution in front of the small stream of gas which then issues out. If 1-20,000th part only of the bulk of gas should be sulphuretted hydrogen, it will produce a brown spot on the card; and as the whole of the gas, after undergoing this scrutiny, passes through the last purifier, it may now be considered quite pure. When the card shows any impurity, the fresh cream is admitted more freely, and the spoiled lime drawn away from the lowest vessel. This stuff, which has a nauseous smell, used to be allowed to run to waste, to the great annoyance of the public; but it is now usually dried, and employed as cement to lute the covers to the retorts.

In the *manufacture of oil gas* all the processes of filling and emptying retorts, condensing, and purifying, are avoided. It is only necessary to project a small stream of oil into a red-hot retort, in which pieces of brick or coke are inclosed; the gas immediately passes off through another pipe, and may be at once received into the gasometer. The only purification necessary, if it can be called so, is to allow the gas to pass through some cool vessel, which may receive any undecomposed oil that may have been carried off, to prevent its being wasted in the gasometer.



The gasometer *a* is a very large cylindrical vessel from 30 to 60 feet in diameter, closed at the top and open at bottom; it is suspended by a rope and weight *e* in a tank filled with water, in which it rises and falls freely, being kept in its place by the guide-wheels *f f*. Two tubes *c c* pass under and through the water, reaching above its surface into the hollow of the gasometer: one of them comes from the purifiers to admit the gas into the gasometer, the other carries it off when wanted for use. The action of this part of the apparatus is simple; in the figure the gasometer is near the top of the water, and full of gas, which has no communication with the air, because the edge of the gasometer is under water. If now it be pressed downwards, which is effected by lessening the weight *e*, the gas will be forced through the pipe which is to convey the gas out, and which must be left open for the purpose. When the gasometer reaches the bottom it will be full of water, and ready to receive gas again, which is admitted through the other tube; the gasometer then rises to the top as the gas goes in, and may be pressed down again. In this way it is alternately filled and emptied. In most establishments there are many gasometers, some filling, and others emptying. As it is a most unwieldy part of the apparatus, and takes up an enormous deal of room, many attempts have been made to lessen its bulk. The only contrivance which has succeeded in diminishing the inconvenience is termed the *telescope gasometer*, which has recently been adopted in several of the metropolitan establishments. In this plan, two gasometers, one inside the other, are placed in a single tank; they are shown in the figure as when drawn up and full of gas, but without any of the necessary appendages. When the gas is let in, the smaller gasometer rises first, and when it reaches the top of the water, its lower rim, which is turned up, and full of water, catches the upper rim of the larger gasometer, which is turned down over it; the two then become one, and the water which runs round the rim prevents the gas from getting out between them. This gasometer is not in reality less bulky than the old one, but as the increased space it takes up is in height, and not breadth, nearly one half of the area is saved; and there seems to be no reason



why three or more cylinders should not be placed in one tank in a similar way.

Many other contrivances are used before the gas is carried to its destination: a meter, to measure it; a governor, to equalize the flow; a pressure-gauge, to indicate the resistance offered to its passage; a tell-tale, to show the quantity manufactured during every hour: but the description of these would exceed our limits.

The tubes which convey the gas are of course larger or smaller according to the number of burners which they supply. The largest in use are about eighteen inches in diameter, the smallest about a quarter of an inch. A pipe of one inch in diameter is large enough to supply gas producing a light equal to that of 100 mould candles, each consuming 175 grains of tallow per hour; and the quantity supplied by larger tubes is more than proportionably larger, a four-inch pipe equalling 2000 candles, instead of 1600. This augmentation arises from the diminished friction in large tubes. In laying the pipes care is taken to place them sufficiently deep under the surface of the ground to be safe from injury by carriages rolling over, and they are disposed in straight lines so far as is practicable. They are also laid in slightly inclined planes, and a vessel is placed at the bottom of each descent to receive and carry off any deposition which would otherwise clog the pipes. They are cast with a socket at one end, in which the smaller end of the adjoining pipe is inserted, and the two are joined by running lead between the joints, which is driven in hard by a punch.

The burners are of many different forms, and each has its technical name. The argand burner is like the lamp of that name. The fan is a spreading semicircle of small jets. The cock-spur, a head with three jets only. The batswing is a thin sheet of gas produced by its passing through a fine saw-cut in a hollow globe. The argand and the batswing are said to give the best light with a given quantity of gas, but this seems to be very uncertain.

The gas is turned off from the burners by a stop-cock, and some curious inventions have been produced to make the stop-cock close of itself by the cooling of the burner when the light is from any cause extinguished. A patent has recently been taken out for a stop-cock which appears less likely to get out of order than those commonly used. In this invention the gas is stopped off by a piece of leather which is pressed against a portion of the tube where the gas passes, by means of a brass screw working in a hole at the side of the tube. The gas does not come in contact with the brass-work, so that no corrosion takes place, and a frequent cause of escape is thereby obviated.

Experiment has shown that every burner should have its full supply of gas, as a greater light will thus be obtained without a proportionate increase of consumption. The experiment was tried with an argand burner of three-quarters of an inch in diameter; a sufficient quantity of gas was turned on to give a light equal to that of a mould candle; the consumption in this case was a foot and a half per hour. The light was then increased until it equalled four candles, but notwithstanding the light was quadrupled, the consumption of gas was not even doubled; it was only two feet per hour, or half a foot per candle; while in the first trial, the light of one candle consumed a foot and a half, or three times as much. The following statement shows the result of the whole experiment, which was continued as long as the burner consumed all the gas that was admitted; when that

quantity was exceeded the flame became smoky, and the experiment was stopped:—

Light produced.		Consumption per hour.		Consumption of each Candle's Light.
1 candle	..	1·43 feet	..	1·43 feet
4 "	..	1·96 "	..	·49 "
6 "	..	2·40 "	..	·40 "
8 "	..	2·95 "	..	·37 "
10 "	..	3·10 "	..	·31 "

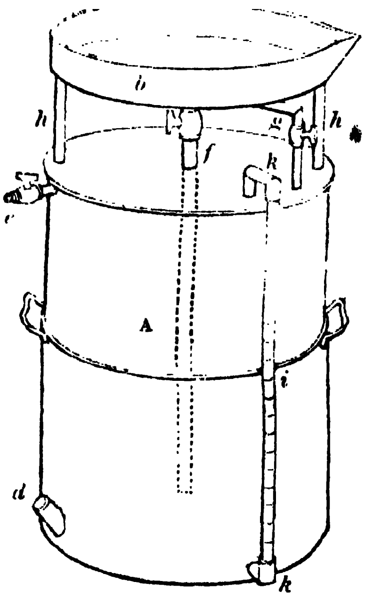
It is evident from this experiment that it is more economical to diminish the number of burners than the supply of gas; and we are of opinion that a plan might be devised by which one or more of the little holes with which a burner is perforated might be stopped off when the light is to be diminished, instead of effecting the same object by lowering the gas.

GASCOIGNE, SIR WILLIAM. [HENRY V.]

GASCONY. [GUIENNE.]

GASHOLDER and GASOMETER. These are vessels employed in the preparation, preserving, and using such gases as are insoluble in water, and employed in chemical investigations.

Many varieties of these have been invented. That which is most useful is Pepys's improved gasometer, of which the annexed cut is a representation. It consists of a copper



cylinder A, on the top of which is supported, by the legs *h h*, the pan or cistern *b*. The hollow cylinder A is plain on the inside, except a small projection at the bottom of *d*. It has the following six openings into it:—From the top proceed the pipes *f* and *g*, each of which also communicates separately with the pan *b*; *f*, as shown by the dotted lines, extends nearly to the bottom of A. The short tube *e* also opens directly into the upper part of the cylinder; *d* is a pretty large opening formed by a short pipe which enters the cylinder at an angle of about 45°, and passes down for an inch or two in the same direction. At this angle the water will not run out through it from the cylinder A, provided all the tubes that would admit the pressure of the air are closed by turning off the cocks. This opening *d* has a stopper which may be screwed on when wanted. Besides these four openings, which are essential to the apparatus, there are two others, *k k*, one at top and the other at bottom, which communicate only with the graduated glass tube *i*, soldered into *k k*, which is of brass: the use of this is to show the level of the water within the cylinder; and the quantity of gas is also read off on the scale.

The cylinder is filled with water by pouring it into the pan *b*; *d* and *e* being closed, and *f* and *g* remaining open, the water runs down into the cylinder, principally at *f*, and the air is expelled from it by the tube *g*, at an opening in the bottom of the pan. When the cylinder A is quite full of water, which is known by inspecting the glass-tube, stop the cocks at *f* and *g*, and open *d*, and the water, as already mentioned, will not flow out. Then introduce the beak of the retort, or the tube from which gas is to issue, so deep into *d* that it projects beyond the inner edge. As the gas rises into A it displaces an equal bulk of water, which now escapes through *d* by the side of the retort beak, or tube which conveys the gas. When the gasometer is so full that the level of the water falls to the bottom of the glass tube, take out the retort, and shut the tube *d* by means of the stopper or screw. The gasometer, now filled with gas, may be safely conveyed anywhere without loss or admixture with the air of the atmosphere.

This apparatus answers various purposes. First, if a bottle or deflagrating jar is to be filled with oxygen or other gas, fill the bottle with water and invert it in the pan *b*, also containing water, and place it over the opening *g*; then open the cocks at *f* and *g*, and the water will sink into the cylinder at *f*, and an equal quantity of gas will rise at *g* and displace the water from the bottle. When this is filled, again shut the cocks at *f* and *g*. If it be required to fill a bladder with gas, screw it on the cock at *e*, open the cock at *f* and let the water sink into the cylinder, and the gas will rise as it did before, but will escape at *e* into the bladder. The opening at *e* is also used for supplying a blow-pipe with gas; this is screwed on and connected with a flexible tube.

This instrument is rather a *gasometer* than a mere gasholder—the latter is a simpler instrument, upon the same principle; but though it may be used for filling a bladder with gas, it cannot be used for filling bottles nor for supplying a blow-pipe.

GASSENDI, PIERRE (properly Gassend), one of the most distinguished of the naturalists, mathematicians, and philosophers of France, was born 22nd January, 1592, at Chantersier, a village near Digne, in the department of the Lower Alps, of poor parents. Richer in virtue than in worldly goods, they were content to sacrifice their own enjoyments to the education of their child, who, before he reached his fifth year, had already given many premature indications of extraordinary powers. At a very early period he evinced a taste for astronomy, which became so strong, that he is said to have often deprived himself of sleep in order to enjoy the contemplation of the heavens; and the following anecdote betokens the precocious development of that talent of observation and deduction for which he was in after-life so eminently distinguished. A dispute having arisen one evening between some children of his own age whether the moon or clouds were moving, and his companions maintaining that the apparent motion was that of the moon, but that the clouds were stationary, Gassendi proceeded to undeceive them by ocular proof: placing his playfellows beneath a tree, he bade them notice that while the moon was steadily visible between the same branches, different clouds were constantly appearing in succession.

Gassendi was sent to school at Digne, where he made rapid progress in the Latin language, and soon acquired a decided pre-eminence over his schoolfellows. Upon completing the usual course, he returned to Chantersier in order to prosecute his studies in retirement; but he had not been there long when he was invited, at the early age of sixteen, to teach rhetoric at Digne. This office he shortly relinquished, and proceeded to Aix to study divinity. In 1614 he was appointed professor of theology at Digne, and two years afterwards he was invited to Aix to fill the chairs of divinity and philosophy, vacant by the death of Fesac, his master and teacher.

The careful perusal of the works of Vives, Ramus, and Patricius, had thoroughly convinced Gassendi of the faults and defects of the philosophy of the schoolmen, or the so-called followers of Aristotle, but it required no ordinary boldness to call it in question. Animated however by the spirit of truth and free inquiry, Gassendi did not hesitate to submit the principles of the schoolmen to a rigorous and searching criticism, and considered it his duty, as a professor of philosophy, to expose the errors of the prevailing theory. This he did indirectly in a work entitled 'Exercitationes paradoxicæ adversus Aristoteleos.' The appearance of the first volume, which was published at Grenoble in 1624, gained for its author a well-established and wide-spread reputation; and if on the one hand it gave great offence to the blind partisans of established doctrines, it was on the other highly esteemed by several learned and distinguished individuals, and particularly by Nicholas Peiresc, president of the university of Aix, by whose interest and influence, assisted by Joseph Walter, prior of Valette, Gassendi was promoted to a canonry in

the cathedral of Digne, where he was admitted to the degree of doctor in divinity, and appointed prevôt of the church. This new situation, which enabled him to vacate the chair at Aix, allowed to Gassendi the undisturbed disposition of his time, which he devoted to the diligent prosecution and advancement of astronomy and anatomy, and to the study of classical literature, and of the works of the ancient philosophers. As the result of his anatomical researches, he composed a treatise to prove that man was intended to live upon vegetables, and that animal food, as contrary to the human constitution, is baneful and unwholesome. In 1629 a second volume of his 'Exercitationes' appeared, the object of which was to expose the futility of the Aristotelian scholastic logic. At the same time five more volumes, in further consideration of the same subject, were announced; but in consequence of the bitter hostility which his attacks upon the favorite system had awakened in its advocates, Gassendi deemed it prudent to abandon the design.

In 1628 Gassendi visited Holland with a view to gain and to cultivate an acquaintance with the philosophers of that country. During his residence there he composed, at the instance of his friend Mersenne, the work entitled 'Examen Philosophicum Robti. Fludd,' in answer to the dissertation of our countryman on the subject of the Mosaic philosophy. Upon his return to Digne, Gassendi applied himself with great diligence to astronomical studies, for which his fondness had grown with his years, and he had the good fortune, on the 7th November, 1631, to be the first to observe a transit of the planet Mercury over the sun's disc which had been previously calculated by Kepler.

In the year 1641, being called to Paris by a law-suit arising out of the affairs of the chapter, his amiable disposition and brilliant talents obtained for Gassendi the regard and esteem of the most distinguished persons of the metropolis of France, and the friendship of the Cardinal Richelieu and of his brother the Cardinal du Plessis, archbishop of Lyon. At this period Des Cartes, with whom Gassendi had long maintained a close and friendly intercourse, was working a reform in philosophy, and by the publication of his 'Meditationes' had opened for it a new and more useful career. In this work however Gassendi discovered much that was objectionable, and forthwith attacked the philosophical system of his friend in a work entitled 'Disquisitio Metaphysica, seu Dubitationes ad Meditationes Cartesii,' which was put into the hands of Des Cartes by their mutual friend Mersenne. Des Cartes wrote an answer, which he published together with the 'Doubts,' under the head, 'Sixth Objection to the Meditations.' In 1643 Gassendi composed the 'Instantiæ' in reply, and circulated them in MS. in Paris before he sent them to M. Sorbière to be printed at Amsterdam. The latter circumstance tended to confirm and widen the difference which, in the course of the controversy, had grown up between the two friends, who however entertained a sincere respect for each other, and were eventually reconciled by the kindly offices of a common friend, the Abbé d'Estrées. Baillet, the biographer of Des Cartes, ascribes the publication of the 'Doubts' to secret jealousy of the growing fame of the author of the Meditations, and to chagrin on the part of Gassendi at the omission in Des Cartes's Treatise of Meteors of his Dissertation upon the singular phenomenon of two parhelia which had been observed at Rome. But the mind of Gassendi seems to have been superior to the influence of such paltry motives, and the origin of the work in question may more justly be referred to the love of truth, which to Gassendi was dearer than friendship itself. Moreover, there was much in their respective characters that was calculated to lead to difference of opinion upon speculative matters. Carried away by a lively imagination, Des Cartes thought it sufficient to draw from his own mind and his individual consciousness the materials for constructing a new system of philosophy; whereas Gassendi, a man of immense learning, and the declared enemy of whatever had the appearance of novelty, was strongly biassed in favour of antiquity. Chimæra for chimæra, he preferred that which had at least the prescription of 2000 years in its favour. From Democritus and Epicurus, whose opinions were above all others most easily reconcileable with his own scientific information, Gassendi drew whatever was well-founded and rational in their system to form the basis of his own physiology. Having restored the doctrine of Atoms and a Void with such slight modification that at most perhaps he did but lend to it a modern style and language, his philosophy had the glory of dividing with Des Cartes the empire of the French philosophical world.

In 1645 Gassendi was appointed professor of mathematics in the College Royal of Paris, upon the nomination and by the influence of Cardinal du Plessis. As this institution was intended principally for the advancement of astronomy, he read lectures upon that science to a crowded and distinguished audience, by which he increased the reputation he had previously acquired, and quickly became the focus of the literary activity of France, so far as it was directed to his favourite sciences of mathematics and astronomy.

But the intensity of his studies had undermined the constitution of Gassendi, and a severe cold having occasioned inflammation of the lungs, he was forced to retire to Digne for the restoration of his health. In this retirement however he was far from idle. In 1647 he published his principal work, 'De Vitâ et Moribus Epicuri,' in which he clears the character of this philosopher from the mist of prejudice with which it had been invested and unfairly handed down to posterity. The 'Syntagma Philosophiæ Epicureæ,' which followed in 1649, is an attempt to reconstruct the system of Epicurus out of the extant fragments, and to give a complete and connected exposition of his theory. Notwithstanding the express refutation, which Gassendi subjoined, of the errors, both physical and moral, of this philosopher, and despite the purity of his own moral character and the exactitude of his religious observances, the sincerity of his religious belief was doubted by those who were constrained to admit the learning and critical acuteness which the work displayed; eventually however the injustice of the calumny redounded to the disgrace of his envious traducers.

His native air having produced a considerable amelioration in his strength, Gassendi was able to return to Paris in 1653, and the next year he published 'Tychonis Brahaei, Copernici, Peurbachii, &c. Vitæ,' a work which was not confined to the biography of these great men, but also contained a brief sketch of antient and modern astronomy down to his own day. The resumption of his literary labours quickly brought on a return of his former disorder, and he died on the 14th October, 1655, in the sixty-third year of his age. His valuable collection of books and his astronomical and philosophical apparatus were purchased by the Emperor Ferdinand III., and deposited in the Imperial library at Vienna.

The philosophical reserve and moderation of Gassendi have led Bayle to designate him as a sceptic, which however, to judge at least from his writings, is little in accordance with the spirit of his philosophy; for although he often complains of the weakness of human reason, which even in the sphere of physical investigations is constantly at fault, and therefore admits the insufficiency of his own discoveries to satisfy either himself or others, this circumstance, while it rendered him patient in controversy and unwilling to enforce his own conclusions upon others, only proves at most that his dogmatism was not as one-sided and immoderate as that of other dogmatists, and that even while he insisted upon the possibility of establishing positive results, he was yet sceptical enough to doubt the finality of his own positions.

By the philosophical cast of his mind and the variety of his acquirements, as well as by the amiable moderation of his character, Gassendi was one of the brightest ornaments of his age. Bayle has justly styled him the greatest philosopher among scholars, and the greatest scholar among philosophers. He may have been surpassed by some of his contemporaries in particular departments of inquiry, as, for instance, by Des Cartes, in the higher branches of mathematics, yet none came near to him in reach and universality of genius. Varied as was his erudition, it did not overpower the clearness of his intellect, the too common result of great learning; on the contrary, his works are distinguished for the perspicuous arrangement of the ideas, the justice of the reasoning, the acuteness of the criticism, and the pre-eminent lucidness of the style and diction.

The works of Gassendi were collected by Montmort and Sorbière, 6 vols., fol., Lyon, 1658; and by Averrani, 6 vols., fol., Firenze, 1728. There is a life of Gassendi by Sorbière, prefixed to the collected works, and one by Bougerel, Paris, 1737.

GASTERO'PODA,* the third class of Mollusks, according to the system of Cuvier, who remarks that it is very numerous, and that an idea may be formed of it from the slugs and shell-snails. Before we proceed to the sections, or rather orders, into which Cuvier has subdivided this extensive congregation, it will be necessary to put the reader in possession of his views of the conformation necessary to bring a molluscous animal within the class of Gastropods.

These mollusks, then, according to the great French zoologist, generally creep upon a fleshy disk placed under the belly; but which sometimes takes the form of a furrow or that of a vertical plate. The back is furnished with a mantle, which is more or less extensive, presents diversities of form, and, in the greatest number of genera, produces a shell. The head, placed in front, shows itself more or less, according to its greater or less retirement under the mantle, and is furnished with small tentacles, which are above the mouth, and never surround it. Their number ranges from two to six, and they are sometimes altogether wanting. Their proper use is only for touching, and, at the most, for smelling. The eyes are very small, sometimes adhering to the head; sometimes at the base, or at the side, or at the point of the tentacle; and sometimes these organs are altogether wanting. The position, the structure, and the nature of the respiratory organs vary, and afford grounds for dividing the animals into many families; but they never have any other than a single aortic heart, that is to say, placed between the pulmonary vein and the aorta. The site of the apertures by which the organs of generation come out and that of the vent vary; but they are nearly always on the right side of the body.

Many of the Gastropods are absolutely naked; others have only a concealed shell; but the greater number carry a shell, which is capable of receiving and sheltering them.

These shells are produced in the thickness of the mantle; some of them are symmetrical, consisting of more pieces than one; others are symmetrical, but formed of a single piece; and there are also some non-symmetrical, which in species where they are very concave, and where they grow a long time, necessarily produce an oblique spire. If the reader will imagine an oblique cone in which other cones are successively placed, always larger in a certain direction than in the others, it will follow that the whole rolls itself upon the side which is least. The part on which the cone is rolled is called the *Columella*, or *Pillar*: this is sometimes solid, and sometimes hollow. When it is hollow, the open end of it is named the *Umbilicus*. The whorls of the shell may remain nearly on the same plane, or may extend towards the base of the columella. In the last case, the preceding whorls are raised one above the other, and form what is called the *Spire*, which is pointed in proportion to the more rapid descent and small enlargement of the whorls. Those shells with an elongated or projecting spire are termed *Turbinated Shells*. When, on the contrary, the whorls remain nearly on the same plane, and are not enveloped one within another, the spire is flat or even concave. These are called *Discoïd Shells*. When the upper part of each whorl envelops the preceding ones, the spire is said to be concealed. That part of the shell from which the animal comes forth is termed the *Aperture*. When the whorls remain nearly on the same plane, the animal, when it creeps, carries its shell disposed vertically, the columella lying across the posterior part of the back; and its head passes under the border of the aperture opposed to the columella. When the spire is elongated, it is directed obliquely to the right in almost all the species: a small number only have it directed to the left when they creep; these shells are called *Reversed* or *Left-handed Shells*. The heart is always on the side opposite to that where the spire is directed. It is therefore ordinarily on the left side; in the reversed or left-handed shells it is on the right. The contrary of this disposition holds good with regard to the organs of generation.

The organs of respiration, which are always situated in the last whorl of the shell, receive the ambient element under its edge, sometimes by means of the mantle being entirely detached from the body along the whole length of this edge, sometimes in consequence of its being merely pierced by a hole. The border of the mantle is sometimes prolonged into a canal, so that the animal can advance to seek the surrounding fluid without exposing either its head or foot beyond the shell. For this purpose the shell, in such cases, has also on its edge, near to that end of the columella (the base) which is opposed to that whereto the spire tends (the apex), a notch or a canal for the lodgment of that of the mantle. The canal is consequently on the left in the ordinary species, and on the right in the reversed shells. The animal being very flexible, is able to vary the direction of its shell, and most frequently when there is a notch or a canal, it is directed forwards; the spire is thus behind, the columella on the left, and the opposite border, or external lip, as it is termed by some conchologists, on the right. A directly contrary disposition is manifested in the Reversed Shells, and these, in consequence of this contrary disposition, turn towards the left instead of turning towards the right, as in the normal structure. It follows as a consequence that the aperture of the shell, which is formed principally by the last whorl, is more or less large in proportion to the other whorls, accordingly as the head or foot of the animal, which is to be constantly protruded therefrom and retracted thereunto, is more or less voluminous compared with the mass of the viscera which remain fixed within the shell. The aperture is moreover wider or narrower in proportion as the same parts are more or less thick. There are shells whose aperture is narrow and long; the foot, in such cases, is delicate and doubles together for the purpose of re-admission. The greater number of aquatic Gastropods with a spiral shell have an *operculum*, or separate piece, which is sometimes horny, sometimes calcareous, attached on the posterior part of the foot, and which shuts the shell when the animal has re-entered it and is entirely retracted within.

Such is Cuvier's description of the shell which covers the testaceous Gastropods. The organization and general structure of *Shell* will be treated of under the proper head, and will be illustrated with explanatory figures. [SHELL; PEARL.] As far as this work has already proceeded, the reader will find examples of some of the forms of the shells of Gastropods under the articles AURICULA, vol. iii., p. 109; BULINUS, vol. vi., p. 7; BULLADÆ, vol. vi., p. 12; CERVICOBRANCHIATA, vol. vi., p. 440; CHISMOBRANCHIATA, vol. vii., p. 93; CHITONS, vol. vii., p. 94; CONUS, vol. vii., p. 484; CYPRÆIDÆ, vol. viii., p. 254; ENTOMOSTOMATA, vol. ix., p. 450, &c.

Cuvier, in continuation, remarks that there are Gastropods with the sexes separate, and others which are hermaphrodites: of these last some have the power of reproduction without the aid of a second individual, while the others require a reciprocal copulation for the continuation of the species. He adds that the organs of digestion present as many differences as those of respiration, and he divides the class into the following orders.

1. Les Pulmonés, Pulmonifera. (Pulmobranchiata of De Blainville.)

This order is distinguished from the mollusks inasmuch as they respire the elastic atmospheric air by means of a hole opened under the border of their mantle, and which they dilate or contract at their pleasure. They have consequently no *branchiæ*, or gills, but only a net-work of pulmonary vessels, which creep around the walls and principally upon the *plafond* of their respiratory cavity. Some are terrestrial, others aquatic; but these last are obliged to come to the surface of the water from time to time, in order to open the orifice of their pectoral cavity for the purpose of respiration.

The *Terrestrial pulmoniferous mollusks* have all four tentacles; two or three only, of very small dimensions, have not permitted the observer to see the lower pair. They are divided into those which are naked, and those which are protected by a shell. They are all hermaphrodites.

Those which have no apparent shell formed the great genus *Limax* of Linnæus; and of these every one may find examples in the common slugs. [LIMAX.] *Parmacella* and *Testacella* lead the way to

Those which have a complete and apparent shell, the borders of whose aperture, in the majority of instances, are reflected into a little roll *(bourrelet)* when the animal is adult. These were placed by Linnæus under his great genus *Helix*. The shell varies much in form; being, for instance, subglobular or subdiscoïd, as in many of the shell-

* *Gasteropoda*, *Trachelipoda*, and *Heteropoda*, of Lamarck; *Paracephalophora* and *Polyplaxiphora*, of De Blainville; part of the *Heterogangliata* of Owen. The nervous system of the *Heterogangliata* (Acephalans or Conchifers, Gastropods, and Cephalopods) consists of nervous filaments and ganglions for the most part irregularly or unsymmetrically disposed. The *Heterogangliata* comprise all the *Mollusca* of Cuvier, with the exception of the *Cirripeda*.

snails; or elongated and pyramidal, as in *Bulinus*, &c. [HELICIDÆ.]

The *Aquatic pulmoniferous mollusks* have only two tentacula, and always come to the surface to breathe; they do not therefore inhabit deep waters, but live for the most part in the fresh waters or salt lakes, or at least near the sides and mouths of rivers.

Cuvier goes on to give *Onchidium*, Buchanan, (*Peronia* of De Blainville) [CYCLOBRANCHIATA, vol. viii. p. 249] as an example of the Aquatic pulmoniferous mollusks without shells.

Those with shells, which are sometimes discoïd as in *Planorbis*, or elongated and pyramidal, as in *Limnæa*, &c., he illustrates by the genera *Physa*, *Scarabæus*, *Auricula*, and *Conovulus*.

2. Nudibranchiata. (Polybranchiata,—Tritonia, &c., of De Blainville.)

The mollusks composing this order have no shell, nor any pulmonary cavity; but their branchiæ are naked, and placed upon some part of the back. They are all hermaphrodites and marine. They often swim reversed, with the foot concave like a boat, at the surface, aiding their progression with their mantle and tentacles as with oars. A notice of *Doris*, *Polycera*, and *Onchidoris*, three of the genera placed by Cuvier under this order, will be found under the article CYCLOBRANCHIATA, vol. viii. p. 249.

3. Inferobranchiata.

This order presents nearly the same form and organization as the *Dorides* and *Tritoniæ*: but their branchiæ, instead of being placed upon their backs, are arranged in two long rows of leaflet-like appendages on each side of the body under the projecting border of the mantle. *Phyllidia* and *Diphyllidia*, Cuv., belong to the *Inferobranchiata*.

4. Tectibranchiata. (Monopleurobranchiata of De Blainville.)

This order has the branchiæ attached either along the right side or upon the back, in the form of leaflets, which are more or less divided, but not symmetrical. The mantle covers the branchiæ more or less, and almost always contains in its thickness a small shell. The *Tectibranchiata* approach the *Pectinibranchiata* in the form of the organs of respiration, and live like them in the sea; but the *Tectibranchiata* are all hermaphrodites, like the *Nudibranchiata* and *Pulmonifera*. The genera *Pleurobranchus*, Cuv., *Pleurobranchæa*, Meckel, *Pleurobranchidium*, De Blainville *Aplysia*, Linn.; *Dolabella*, Lam.; *Notarchus*, Cuv.; *Bursatella*, Blainv.; *Akera*, Müll.; *Bullæa*, Lam.; part of *Bulla*, Linn.; *Gasteroptera*, Meck.; *Umbrella*, Lam.; *Gastroplex*, Blainv.:—belong to this order. The reader will find a notice of BURSATELLA under that head, vol. vi. p. 47, and of *Akera*, *Bullæa*, *Bulla*, and *Gasteroptera*, under the title BULLADÆ, vol. vi. p. 11. The *Aplysiacea*, including *Dolabella*, *Notarchus*, &c., will be noticed under the title TECTIBRANCHIATA; and *Umbrella*, under that of PATELLOIDEA.

These four orders are united by M. de Blainville under the name of *Paracephalophora Monoica*.

5. Heteropoda, Lam. (Nectopoda, Blainv.)

Distinguished from all the others, inasmuch as their foot, instead of forming a horizontal disk, is compressed into a muscular vertical plate, which serves them as a fin, and at the edge of which, in many species, a dilatation, in form of a hollow cone, represents the disk of the other orders. Their branchiæ, formed of feathery lobes, are situated on the posterior part and left side of the back, directed forwards; and immediately behind them are the heart and a liver of no great size, with a part of the viscera and the internal organs of generation. Their body, lined with a muscular coat, is elongated, terminating most frequently by a compressed tail. Their mouth is formed by a muscular mass, and is furnished with a tongue beset with small hooks. The œsophagus is very long, the stomach delicate in texture, and two tubes at the right side of the packet of viscera give exit to the excrements and to the ova or to the prolific fluid. They generally swim with the back downwards and the foot above, and they can swell out their bodies by filling them with water by means which are not as yet well understood.

To this description Cuvier adds, that the method of swimming above described having induced Peron to believe that the natatory plate was on the back, and the heart and branchiæ under the belly, has given rise to many errors as to the proper place of these animals. Cuvier adds, that the examination of their nervous system led him to the opinion expressed in his memoir on the *Mollusca*, that they were analogous to the Gastropods. A more complete dissection, he observes, made since, and that given by Poli, in his third volume, have completely confirmed this conjecture, and he states that the fact is that the *Heteropoda* differ but little from the *Tectibranchiata*. M. Laurillard believes that the sexes are always separate. Cuvier also remarks, that M. de Blainville makes of his (Cuvier's) *Heteropoda* a family which he names *Nectopoda*, and unites them with another family which he names *Pteropoda*, and which comprehends none of Cuvier's Pteropoda, except *Limacina*. To this, Cuvier observes, M. de Blainville refers *Argonauta*, upon what conjecture Cuvier knows not.

Forskal places all the *Heteropoda* of Cuvier under his genus *Pterotrachea*.

In this work, the type of the family, CARINARIA, is described and figured under that title, vol. vi. p. 294, and ATLANTA is noticed and figured in vol. iii. p. 24. The other genera will be found under the article HETEROPODA.

6. Pectinibranchiata. (Paracephalophora Dioica, Blainv.)

This order is by far the most numerous division of the Gastropods, for it embraces nearly all those which have spiral univalve shells, and many of those whose shells are simply conical. Their branchiæ, composed of numerous leaflets or fringes (lanières) ranged in parallel order like the teeth of a comb (whence their name), are attached upon one, two, or three lines, according to the genus, to the *plafond* of the pulmonary cavity, which occupies the last whorl of the shell, and which forms a large opening between the border of the mantle and the body. Two genera only (*Cyclostoma* and *Helicina*) have, in the place of branchiæ, a vascular net covering the *plafond* of a cavity similar in other respects: these are the only genera which breathe air; all the others respire water.

All the *Pectinibranchiata* have two tentacula and two eyes sometimes carried on their proper peduncles, a mouth in form of a proboscis, which is more or less elongated, and the sexes separate. The intromissive organ of the male, which is attached to the side of the neck, cannot ordinarily be retracted into the body, but is reflected in the branchial cavity, and is sometimes very large, as may be seen in the figure of *Buccinum undatum* (ENTOMOSTOMATA, vol. ix. p 454), which will give a general idea of the form of a marine Pectinibranchiate testaceous mollusk, with a turbinated shell. *Paludina* indeed can cause this organ to re-enter the body by an orifice pierced at its right tentacle. The rectum and oviduct of the female creep also along the right side of the branchial cavity, and between them and the branchiæ is a particular organ composed of cellules containing a very viscous liquor, serving to form a common envelopment or case, which includes the eggs, and which the animal deposits with them. Several of these deposited ovaries present very complicated and singular forms, and may be often found on the sea-beach.

The tongue of the *Pectinibranchiata* is armed with small hooks, and files down the hardest bodies by slow and repeated friction.

The greatest difference among these animals consists in the presence or absence of the canal formed by a prolongation of the border of the pulmonary cavity of the left side, and which passes by means of a similar canal, or by a notch in the shell, so as to enable the animal to respire without leaving the shelter of its shell. Some of the genera again are without an *operculum*; and the species also exhibit differences in the filaments, fringes, and other ornaments exhibited on their head, their foot, or their mantle. These mollusks are arranged under many families, according to the form of their shells, which, generally speaking, present a sufficiently constant relation to the form of the animal. But the student should remember that this is not a rule without exception, as Mr. Gray has pointed out in his interesting paper in the 'Philosophical Transactions.'

The reader will find the numerous genera—the leading ones at least—of this most extensive order, principally under the titles of the different families into which they have been separated by zoologists; and sometimes under their generic appellations.

7. Tubulibranchiata.

Cuvier considers that this order should be detached from

the *Pectinibranchiata*, to which they nevertheless bear great resemblance, because their shell (which is in the form of a tube more or less irregular, the commencement of which only is turbinated or spiral) is fixed to different foreign bodies: they have in consequence no true copulative organs, and fecundate themselves. *Vermetus*, *Magilus*, and *Siliquaria* (all marine) belong to this order.

8. Scutibranchiata. (Paracephalophora Hermaphroditica, with exception of the Chitons, De Blainv.)

This order consists of Gastropods which bear a near relationship to the *Pectinibranchiata* in the shape and position of the branchiæ, as well as in the general form of the body, but which have the sexes united in the same individual. The shells of this order are always without an operculum, very wide in the opening (some of them may be said to be almost all aperture), and many of them have shells without any turbination, so that they cover the animal, and especially its branchiæ, like a shield. The heart is traversed by the rectum, and receives the blood by two auricles, as in the generality of Bivalves. Under this order Cuvier, in his last edition of the 'Règne Animal' places the *Haliotidæ* (Ear-shells), *Stomatia*, *Fissurella*, *Emarginula*, and *Parmophorus*. The reader will find *Fissurella*, *Emarginula*, and *Parmophorus* treated of in the article CERVICOBRANCHIATA, vol. vi. p. 443.

9. Cyclobranchiata.* (Cervicobranchiata, Blainv.)

Branchiæ in form of small leaflets or little pyramids, attached in a *cordon* more or less complete under the borders of the mantle, nearly as in the *Inferobrachiata*, from which the *Cyclobranchiata* are distinguished by their hermaphroditism; for they have no organs of copulation, and can reproduce the species without having recourse to a second individual. The heart does not embrace the rectum, but it varies in situation.

The genera *Patella* and *Chiton*, the only forms admitted by Cuvier to belong to his Cyclobranchians, are treated of under the articles CERVICOBRANCHIATA and CHITONS.

Such is Cuvier's arrangement; and, based as it is on anatomical investigation, there can be no doubt that, as a whole, it rests on a sure foundation, however necessary it may be for the more ready classification of the forms to have recourse to arbitrary methods. M. Rang adopts it, adding as orders De Blainville's *Nucleobranchiata* for Lamarck's *Heteropoda*, and De Blainville's *Cirrhobranchiata* for the genus *Dentalium*. [DENTALIUM, vol. viii., p. 404.]

FOSSIL GASTEROPODA.

A class which comprehends so great a number of animated organized beings, having the most extensive geographical range—a class embracing an immense mass of mollusks, multitudes of which are littoral, many terrestrial and inhabitants of the fresh waters, and a considerable number pelagic, for the most part protected by hard calcareous shells, presents materials, in a fossil state, of the greatest consequence to the geologist for decyphering the mineral structure of the earth.

Mr. Dillwyn, as is noticed by Dr. Buckland in his 'Bridgewater Treatise,' asserts that every fossil turbinated univalve of the older beds, from the transition lime to the lias, belongs to the herbivorous genera; and that the herbivorous class extends through every stratum in the entire series of geological formations, and still retains its place among the inhabitants of our existing seas. On the other hand the shells of marine carnivorous univalves are very abundant in the tertiary strata above the chalk, but are rare in the secondary strata from the chalk downwards to the inferior oolite; beneath which no trace of them has yet been found. Dr. Buckland further seems to be of opinion that, in the economy of sub-marine life, the great family of carnivorous trachelipods performed the same necessary office during the tertiary period which is allotted to them in the present ocean, and he alludes to the evidence showing that in times anterior to and during the deposition of the chalk, the same important functions were consigned to other carnivorous mollusks (the testaceous cephalopods), which are of comparatively rare occurrence in the tertiary strata in our modern seas; but throughout the secondary and transition formations, where carnivorous trachelipods are either wholy wanting or extremely scarce, there occur abundant remains of carnivorous cephalopods, consisting of the chambered shells of nautili and ammonites, and many kindred extinct genera of polythalamous shells. Their sudden and nearly total disappearance, as Dr. Buckland remarks, would have allowed the herbivorous tribes to increase to an excess that would ultimately have been destructive of marine vegetation, as well as of themselves, had they not been replaced by a different order of carnivorous creatures destined to perform in another manner the office executed by the various extinct genera of testaceous cephalopods. 'From that time onwards,' continues Dr. Buckland, 'we have evidence of the abundance of carnivorous trachelipods, and we see good reason to adopt the conclusion of Mr. Dillwyn, that in the formations above the chalk the vast and sudden decrease of one predaceous tribe has been provided for by the creation of many new genera and species, possessed of similar appetencies, and yet formed for obtaining their prey by habits entirely different from those of the cephalopods.'

The reader will find the fossil Gastropods noticed more in detail under the titles of the different families and genera.

GASTERO'PTERA. [BULLADÆ, vol. vi., p. 13.]

GASTERO'STEUS. [STICKLEBACK.]

GASTRIC JUICE. This term is applied to the fluid, secreted from the interior of the stomach, which is the principal agent in digestion. The gastric juice is a transparent slightly viscid liquid, which, when obtained from the stomach of an animal while fasting, possesses neither acid nor alkaline re-action, but has a saline taste. During the process of digestion, on the contrary, it is distinctly acid. Gastric juice possesses strong antiseptic properties, suspending putrefaction, and restoring the freshness of tainted meat: it also coagulates milk, which property is independent of the presence of any acid. But the most remarkable quality of the secretion of the stomach is its solvent effect, which will even act on nutritive substances out of the body. This power of solution cannot be explained satisfactorily on chemical principles, as there appears to be little connection between the properties and composition of this fluid. Tiedemann and Gmelin have ascribed its solvent qualities to the action of muriatic and acetic acids, which they say are always secreted during the digestive process; but they have not shown that, when in its neutral state, it is devoid of the solvent action, which proof is necessary to determine that the presence of the acid is indispensable. The chemical composition of gastric juice is involved in much obscurity from the difficulty of obtaining this fluid in a pure state, but it does not differ materially from that of some other animal fluids, as saliva, or from the secretions of mucous membrane generally: it consists of a large proportion of water, with some mucus, and certain salts in small quantities, the most plentiful of which is muriate of soda. The free muriatic acid which is sometimes found should rather be considered as developed during the process of digestion, and not as entering into the regular constitution of the fluid. With regard to the origin of the gastric juice, it is secreted by numerous small glands situated beneath the mucous membrane, and opening into the stomach by many minute apertures, from the orifices of which the fluid may be seen with a microscope to distil. These glands of the stomach are single, and vary in diameter from ·02 to ·08 of an inch; the largest are situated towards the fundus of the organ, the smaller towards the pylorus. The use of the gastric juice is to act on the food as a chemical solvent, and thus perform the first process of digestion; the office of the stomach being to convert the nutritive materials of food into a uniform semifluid mass, called chyme; which change is wrought, as many experiments have shown, through the exclusive influence of the fluids of the stomach. [DIGESTION.]

GASTROCHÆ'NA, a genus of Acephalous Mollusks or Conchifers, established by Spengler. Lamarck places it between *Pholas* and *Solen*, and Cuvier between *Fistulana* and *Teredina*. M. Deshayes, in his edition of the '*Animaux sans vertèbres*,' says that it is evident that Lamarck came to very erroneous conclusions as to this genus. The animal, observes M. Deshayes, has two posterior very short siphons when it is contracted; the lobes of the mantle are united up to the gape of the valves and even a little higher; this gaping of the valves, as well as the divarication of the

* The *Cyclobranchiata* are, in Cuvier's last edition of the 'Règne Animal,' headed 'Huitième ordre des Gastéropodes,' and they are cited as the 8th in the articles CERVICOBRANCHIATA, vol. vi. p. 440, and CYCLOBRANCHIATA, vol. viii. p. 248. The preceding order, *Scutibranchiata*, has the same heading: but the *Cyclobranchiata* form the 9th order; and Cuvier appears to have forgotten that he had published the *Tubulibranchiata*, an order which it seems probable from this repetition he may have intercalated.

lobes of the mantle, gives passage to a great short cylindrical foot, like that of the *Pholades*; but this opening is not at all destined for the passage of the siphons, as Lamarck supposed.

Mr. G. B. Sowerby ('Genera of Recent and Fossil Shells') remarks, that the genera *Pholas*, *Mya*, *Mytilus*, and *Chama*, have by turns served as a receptacle of the shells of this genus. He observes, that Lamarck has adopted Spengler's name, but has placed it next to *Pholas*, apparently not having known that the animal forms its own testaceous tube, either as a lining to the hollow it has previously perforated, or as a covering for its shell in those instances in which it has not perforated at all, but in which it has taken up its abode, as it frequently does, within some spiral univalve. Mr. Sowerby is further of opinion, that the fact of the shell being enclosed in a testaceous tube of its own depositing, renders it proper to remove it into Lamarck's family of *Tubicolæ*, to which indeed it appears to Mr. Sowerby to be more nearly related, though he notices a very considerable analogy between the shelly tube of Lamarck's *Tubicolæ*, and the coriaceous epidermis, which not only in a great measure covers the shell, but also encloses the tubes of the animal of Lamarck's *Pholadaceæ*, and Mr. Sowerby consequently thinks that the two families might very properly be united.

Mr. Owen, in his paper on *Clavagella*, remarks how closely that form follows the modifications which have been observed in *Gastrochæna*. [CLAVAGELLA, vol. vii., p. 244.]

Cuvier says that it appears that the *Gastrochænæ* constantly have a calcareous tube, and quotes Dr. Turton, M. Deshayes and M. Audouin as having observed it.

M. Rang says that all the *Gastrochænæ* have not a calcareous tube, though all of them burrow in stones after the manner of *Pholades*. If this is to be taken literally, it does not exactly accord with the fact; for, sometimes, the animal does not burrow at all, at others (and very frequently) it burrows in madrepores. M. Rang adds that two of the species which belonged to the genus *Fistulana* of Lamarck are now arranged in this, and that this arrangement is due to M. de Blainville. These two species, he says, are *Fistulana clava* and *F. Ampullaria*. Of these, *Fistulana clava* is referred, among the synonymes, to *Gastrochæna*, by Lamarck, and *Fistulana ampullaria* is declared by M. Deshayes to be a true *Fistulana*, but remarkable in this, that, according to circumstances, it forms a free tube sunk in the sand, or perforates calcareous bodies, and its tube serves as a lining to the cavity which it inhabits; this species therefore, he observes, would belong to the *Fistulanæ* in the first case, and to the genus *Gastrochæna* in the second; if indeed that genus be preserved.

M. Rang states that M. Charles Des Moulins, who a long time ago, and before the observations made upon this subject, had discovered the existence of a tube in the *Gastrochænæ*, had shown him this tube, not only in the living species on the French coast, but in the fossil at Merignac. Following De Blainville, M. Rang would divide the genus *Gastrochæna* into the two following groups.

α

Species whose shell is smooth and without a distinct tube. Example. *Gastrochæna cuneiformis*, &c.

β

Species whose shell is striated from the umbo to the base, and contained in a distinct tube.

Example. *Gastrochæna clava.*

M. de Blainville states that the animal of *Gastrochæna* has evidently the greatest relationship to that of *Saxicava*; but as it is not entirely contained in its shell, it often supplies the deficiency by forming an artificial tube adhering to the walls of the cavity which it inhabits in calcareous stones.

This tube, in the opinion of M. de Blainville, offers only an accidental character, and would thus make of species, or even of individuals which are provided with it, *Fistulanæ* of Lamarck. Thus, he observes, M. Deshayes has proposed to suppress the genus *Gastrochæna*, but he would consider it more convenient not to admit the genus *Fistulana*; first, because it is founded upon the presence of a tube; and, secondly, because it was established some time after *Gastrochæna*. He would however prefer its restriction as he has restricted it in his *Malacologie*. In uniting the species characterized by the true shell, whether it have an external tube or not, there exist already, he remarks, many species of known *Gastrochænæ*, both living in the seas of warm climates and fossils in his country. M. Defrance, he states, nevertheless quotes one fossil species only at Grignon, and an analogue; and he concludes by observing that *Gastrochæna clava* would perhaps, if it were better known, form a small distinct genus.

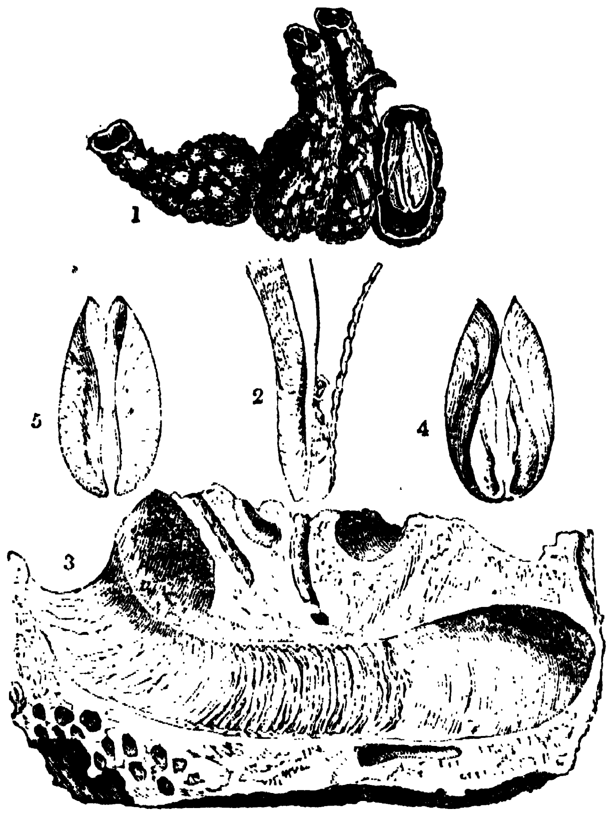
Mr. G. B. Sowerby (*Zool. Proc.* 1834) describes five new species brought home by Mr. Cuming from South America, and the Gallapagos and Lord Hood's Islands.

The following is M. Rang's definition of the genus:—

Animal oval, having the mantle closed with a very small anterior rounded opening for the passage of a small, conical, or linguiform foot: the tubes elongated and united throughout.

Shell delicate, oblique, oval, cuneiform, equivalve, very inequilateral, gaping extremely at its antero-inferior part; *umbones* well marked; *hinge* straight and linear without teeth; an apophysis often showing itself below the hinge in the interior of each valve; *ligament* external; *muscular impressions* distinct, connected by a slightly marked pallial impression excavated posteriorly.

Sometimes a calcareous tube, ampulliform, short, with a rounded aperture, enveloping the shell and lining the cavity of the stone.



1, A group of the tubes of Gastrochæna modiolina, Lam. (Mediterranean): one of the tubes is broken and shows the valves in situ; 2, Fusus Noæ (Grignon) cut open to show the clavate tube of a small fossil Gastrochæna; 3, a worn fragment of a Madrepore, broken to show the tube formed by a specimen of Gastrochæna cuneiformis, Lam.; 4 and 5, two views of the two valves of the last-mentioned species. (From the 'Genera of Recent and Fossil Shells,' by G. B Sowerby, now (January, 1838) in the course of publication, and almost complete.)

The depth at which living *Gastrochænæ* have been found ranges from 3 to 17 fathoms.

FOSSIL GASTROCHÆNÆ.

Among the fossil *Gastrochænæ*, *Gastrochæna tortuosa* has been found in the inferior oolite (Phillips); and Dr. Fitton, in his Stratigraphical Table, records *Gastrochæna* (species doubtful) in the lower green sand, in the Portland stone, in the Portland sand, in the Oxford oolite, and in perforations in dicotyledonous (silicified) wood;—*Gault*, east of Folkstone.

GA'STROPLEX. [GASTEROPODA, vol. xi., p. 92; PATELLOIDEA.]

GATAKER, THOMAS, born in London in 1574, studied at Cambridge, where he took his degrees, was afterwards chaplain to Sir William Cook, and also preacher to the Society of Lincoln's Inn. He applied himself especially to the study of the Scriptures in the Hebrew and Greek text, and wrote several works in illustration of the Old Testament. He also wrote 'Of the Nature and Use of Lots,' a treatise historical and theological, in which he distinguishes between innocent and lawful games of chance, and

those which are unlawful or reprehensible. His arguments having been misrepresented, he had to sustain a polemical correspondence in his own justification. In 1611 he was appointed rector of Rotherhithe. In 1624 he wrote a treatise against Transubstantiation. In 1642 he was chosen to sit in the Assembly of Divines at Westminster, where in several instances he differed from the majority. He afterwards wrote with others the 'Annotations on the Bible,' which were published by the same Assembly; the Notes on Isaiah and Jeremiah are by him. In 1648 Gataker, with other London clergymen, to the number of forty-seven, remonstrated against the measures taken by the Long Parliament with respect to king Charles, and he became in consequence an object of suspicion to the ruling powers, but by his mild and open conduct he escaped personal annoyance. In 1652 he published a Latin translation of M. Aurelius' 'Meditations,' with valuable notes, tables of reference, and a preliminary discourse on the philosophy of the Stoics. In the latter part of his life he had to sustain a controversy against the pretended astrologer William Lilly. He died above eighty years of age. His son Charles published his 'Opera Critica,' 2 vols., fol., Utrecht, 1698, which contain, besides the 'Meditations,' his 'Cinnus,' and 'Adversaria Miscellanea,' being disquisitions on biblical subjects, and 'De Novi Testamenti Stylo,' a philological treatise on the antient languages. Gataker's learning has been greatly praised by Boyle and other competent judges.

GATES, HORATIO, a distinguished American general of the Revolutionary war, was born in England in 1728. He received his military training in the English army, served in the West Indies, and accompanied General Braddock in his disastrous expedition against the French settlements on the Ohio in 1755. [BRADDOCK.] Being wounded in that affair, and obliged for a time to retire from active service, he purchased an estate in Virginia. He took the popular side in the Revolutionary troubles, and was appointed adjutant-general on the breaking out of the war. In 1776 he was sent to command the army on Lake Champlain. His conduct at first was not approved of, insomuch that he was superseded in the spring of 1777; but in the following August he was appointed to oppose General Burgoyne, who had forced his way from the Canadian frontier to the Hudson. An indecisive battle was fought September 18th, and a second October 8th, in which the British were defeated. General Gates then blockaded his adversary at Saratoga, who being disappointed in his hope of forming a junction with the Royalist troops on the Hudson, and cut off from all supplies, found it necessary to capitulate with his whole army. For the terms obtained, see BURGOYNE.*

This convention of Saratoga was one of the most important successes gained in the whole war: for near 6000 men surrendered on parole not to serve again, and their arms and artillery were converted to the use of the victors. Gates became the popular hero of the day: and attempts were made by some intriguing partisans, or misjudging friends, to raise him over the head of Washington. Fortunately for America these attempts came to nothing. In June, 1780, he was appointed to command the southern army, which at that time was in a wretched state of disorganization. It was no wonder therefore that on his first meeting with the British troops [CORNWALLIS] he received, though superior in numbers, a total defeat. This took place August 16th, at Camden, in South Carolina. By great exertion he was again in condition to take the field, when he received news that he was superseded by General Greene, and that Congress had resolved to submit his conduct to a court of inquiry. The investigation lasted until after the close of the war in 1782: in the end he was fully and honourably acquitted of blame.

General Gates then retired to his Virginia estate, from which, in 1800, he removed to New York; to the freedom of which city he was immediately admitted. In 1800 he was elected a member of the state legislature. Before his departure from Virginia he performed the noblest act of his life—the emancipation of his slaves, which he accompanied with a provision for those who needed assistance. He died April 10, 1806. (*American Encyclopædia; Hist. Amer. Revolution.*)

GATESHEAD, an antient borough and parish in the eastern division of Chester ward, in the county palatine of Durham, 272 miles N. by W. from London, and 13 miles N. by E. from Durham. It is situated on the southern side of the river Tyne, opposite to Newcastle, with which it communicates by a handsome stone bridge. The parish is about 3½ miles in length, its greatest width being somewhat more than two. Gateshead is supposed to have once been a fortified Roman station, which opinion is supported by the antiquities discovered here at various times, including coins of the emperor Hadrian. Prior to 1833 it was merely a borough by prescription, there being no charter extant, though it is believed to have been once incorporated. By the Reform Act it became a parliamentary borough, and now returns one member. As late as 1681 the town was governed by a bailiff appointed by the bishops of Durham, since which time the government has been vested in two stewards, who possess no municipal authority or jurisdiction, and who are elected annually by the borough-holders and freemen. There are two principal streets; the one descending towards the bridge is so steep as to be almost impassable for carriages during winter; the other, of recent erection, is of gradual descent. The church is an antient and spacious edifice, built in the form of a cross, surmounted by a lofty tower. There are two livings; the rectory of Gateshead and that of Gateshead-fell. The annual net income of the former, according to the Ecclesiastical-revenue Reports, is 636*l.*, and that of the latter 172*l.* They are both in the archdeaconry and diocese of Durham, and in the patronage of the bishop of that see. There are several charitable institutions, among which is an almshouse for poor women. On the east side of the main street are the ruins of an extensive monastery, founded in 1247 by Bishop Farnham, and dedicated to St. Edmund. The town is said to be thriving and increasing annually in manufacturing and commercial importance. It possesses coal-mines, extensively worked, situated within the borough, and which employ a considerable portion of the population of the town. The chief manufactories are of glass, cast and wrought iron, and whitening; and at Gateshead-fell there is an extensive quarry for grindstones, which are exported to most parts of the kingdom. The population of Gateshead and Gateshead-fell in 1831 was 15,177. There are several charity schools, among which is a free grammar-school founded in 1701 by the Rev. Theophilus Pickering, the rector of the parish. Besides Greek and Latin, the children are taught arithmetic and navigation. The revenue of the borough, arising from landed property, is 500*l.*, which is incumbered with a mortgage of 1600*l.* The annual expenditure is about 200*l.* The amount of assessed taxes levied in 1830 was 2036*l.*, and that of the parochial assessments in the following year 4709*l.*—(*Parliamentary Papers*, &c.)

GATINE or GASTINE, a district of Bas (or Lower) Poitou, in France; now comprehended in the department of Deux Sèvres.

GATINOIS, LE, a district in France, partly comprehended in the government of Ile de France, partly in that of Orléanois; and distinguished accordingly as Gâtinois François and Gâtinois Orléanois. Gâtinois was bounded on the north by Hurepoix and Brie François, on the east by Senonois and Bourgogne, on the south by Nivernois and Berri, and on the west by Orléanois Proper and the districts of Beauce and Chartrain. It extended from the Seine to the Loire, and was watered by the Loire, the Seine, the Loing, the Essonne, and their tributaries. It is now comprehended in the departments of Seine et Oise, Seine et Marne, Loiret, and Yonne. Its chief towns were as follows: Le Gâtinois François—capital Nemours, on the Loing (population 3839), Fontainebleau (pop. 8104 town, 8122 commune), Moret, on the Loing (pop. 1673), Beaumont, Château Laudon, Egreville, Milly (pop. 1881 town, 1941 commune), Courtenoy, on the Clery, and Chenoy, on the Lunain, feeders of the Loing; Le Gâtinois Orléanois—capital, Montargis, on the Loing (pop. 6781), Châtillon sur Loing (pop. 1721 town, 2126 commune), Briare (pop. 2243 town, 2730 commune), Gien (pop. 4631 town, 5177 commune), Puiseaux (pop. 1876 town, 1970 commune), and several others.

The district La Puisaye, capital, St. Fargeau (pop. 1519 town, 2132 commune), was a subdivision of Le Gâtinois Orléanois.

The population of the towns is from the census of 1831.

GATSHINA, a regularly-built town on the Ishora where it expands into a lake, about forty miles south of St. Petersburg, in the government of which it is situated.

* In that article the plan of Burgoyne's campaign is misstated: he marched from Canada to the Hudson—not from the Hudson to Canada.

It was a favourite residence of Paul the First, who conferred municipal privileges on it in 1796. It contains a Greek church, Protestant and Roman Catholic chapels, a large hospital, a free school, an asylum for 800 foundlings, a porcelain, a woollen cloth, and a hat manufactory, &c., and, including its dependencies, has a population of about 6500. Between the lake and the hills behind it, and close to Gatshina, is a handsome imperial palace, with a theatre, riding-house, and chapel, all of freestone, and spacious and very picturesque grounds laid out in the English style.

GATTERER, JOHANN CHRISTOPH, born in 1727, near Nürnberg, became professor of history at Göttingen, where he published numerous useful works on antient history, geography, chronology, genealogy, heraldry, and diplomacy, on all which subjects his information was very extensive. His principal publications are:—1. 'Elementa artis Diplomaticæ Universalis,' 4to., Göttingen, 1765, a work of great and curious research, especially concerning the graphic part, or the various characters, monograms, and symbols used in old diplomacy. 2. 'Handbuch der Universal Historie,' 2 vols. 8vo. 1764–5, in which he gives catalogues of numerous writers on the history of the various countries of Europe and Asia, according to the order of time. 3. 'Stammtäfeln zur Weltgeschichte,' 4to., 1790. 4. 'Einleitung in die Synchronistische Universal Historie,' 2 vols. 8vo., 1771, with chronological tables. 5. 'Abriss der Chronologie,' 1777. 6. 'Handbuch der Neuesten Genealogie,' 1772. 7. 'Allgemeine Historische Bibliothek,' 16 vols. 8vo., Halle, 1771. Gatterer died at Göttingen in 1779.

There was another contemporary professor, Christoph Wilhelm Jacob Gatterer, at Heidelberg, who wrote several works on geology and mineralogy.

GAUBIL, ANTHONY, a learned Jesuit, whose labours greatly advanced our knowledge of the literature of eastern Asia, was born in Languedoc in 1689. He entered the society of the Jesuits in 1704, and was sent in 1723 to China, where he applied himself to the study of the Chinese and Mantchoo languages, in which he made such proficiency that the first Chinese scholars sometimes consulted him about obscure and difficult passages in their authors. Besides the above-mentioned literary occupations Gaubil applied himself with great success to mathematics, and particularly to astronomy, without neglecting the numerous avocations of his ecclesiastical calling. Gaubil arrived in China just after the death of the celebrated Emperor Ching-Tsoo, better known in Europe under the name of Kang-Hi, who was very partial to Europeans, but whose successor was imbued with a strong prejudice against the Christian missionaries. Notwithstanding this unfavourable circumstance, Gaubil succeeded in obtaining the favour of the monarch, and was nominated director of the college, where a number of Mantchoo youths are instructed in Latin and Russian*. He was also employed as interpreter from the Mantchoo into Latin, and from Latin into the Mantchoo, for the diplomatical correspondence between China and Russia. Notwithstanding his multifarious occupations, Gaubil found time to write several important works in China, the first of which is an 'Historical and Critical Treatise on the Chinese Astronomy,' published in the 'Observations Mathematiques, Astronomiques, Géographiques et Physiques tirées des anciens livres Chinois, ou Faites nouvellement aux Indes ou à la Chine, par les Missionnaires-Jesuites, requeillies par le P. Souciet (a Jesuit),' Paris, 1729, 1 vol. 4to. The same collection contains the narrative of a 'Voyage from Peking to Canton,' by Gaubil, which has been likewise inserted by Prevot in the 5th vol. of his 'History of Travels.' But the work which reflects the greatest credit on the abilities of Gaubil is his translation into French of the 'Choo-king,' which contains the earliest traditions respecting the history of China. It was published after his death by Desguignes, in 1771, at Paris. Gaubil published also a 'History of Genghis Khan and his Dynasty' (1739, Paris), which alone, according to the celebrated Chinese scholar Abel Remusat, would be sufficient to establish the reputation of the author. The other works of Gaubil are a 'Description of Peking,' and many essays on China and the adjacent countries, which are inserted in that celebrated collection published by the Jesuits under the title of 'Lettres curieuses et édifiantes,' which contains the description of the countries where they exercised their missionary labours. Gaubil died at Peking in 1759, aged seventy-one, after having resided in China thirty-six years. For further particulars the reader may consult the 31st vol. of the 'Lettres curieuses et édifiantes.'

* According to the treaty of 1728 between Russia and China, all the diplomatic correspondence between those two countries is carried on in Latin, Russian, and Mantchoo, and every despatch must be written in these three languages. A special school was established at Peking, in order to teach Russian to twenty young Mantchoos, who are afterwards placed either in the office for foreign affairs, or in offices on the frontier, where a knowledge of the Russian language is requisite. But notwithstanding all the efforts of the government to support that school, it is very far from being in a state of efficiency; and it is said that in 1805, when the Russian embassy came to Mongolia, the Chinese governor of that province called for some translators educated in the above-mentioned school. He expected to find in them able and trusty interpreters, without being obliged to apply to the Russians; but the first interview proved that he was mistaken. The Mantchoo interpreters confessed that they did not understand a word of what the Russians said, and they were sent back to Peking.

GAUDAMA, or GAUTAMA. [BUDDHA, vol. v., p. 527.]

GAUGING is the method of determining by actual measurement the number of gallons contained in any vessel intended to hold goods. The greatest use of this art is in the collection of the revenue, in which it is necessary to measure the bulk of vessels without disturbing their contents. For this purpose a number of rules have been laid down by various writers, of whom the reader who is interested in the subject may consult Leadbetter's 'Treatise on Gauging,' John Ward's 'Young Mathematician's Guide,' or Dr. Hutton's 'Mensuration.' The rules laid down were, in many cases, of uncertain application; as for instance, a close cask was to be treated either as a frustum of a spheroid, or of a parabolic spindle, or as a double frustum of a paraboloid, or else of a double cone, according to its appearance. The allowance made for the thickness of a cask was a guess, and the method of using *small* sliding-rules, to which supervisors formerly resorted to escape calculation, is a species of estimation which would never have been tolerated in money transactions between man and man. The inference to be drawn from the art as described by early writers, is that, generally speaking, the results of excisemen's measurements were below the truth: had it been otherwise, the fact could not but have been known to merchants and tradesmen, who can gauge their own vessels after the contents are removed, or who learn their bulk in the removal. If the methods of the excisemen were tolerably uniform, which is perhaps pretty nearly true, if we may judge from writers on the subject, no injustice was done by unequal taxation: and the government would probably have found it as easy to increase the duties, as to raise an additional revenue from a more correct method of collecting the old one.

With *larger* sliding-rules for calculation, and the aid of habit derived from experience, it is possible very accurately and easily to measure casks which do not depart much from a given standard of form. This is what is done by gaugers at the present time: and their practice has attained considerable accuracy. In a particular instance which has come to our knowledge, and in the case of a vat which held 6500 gallons, the measurement of the exciseman did not differ more than ten gallons from the truth. This degree of accuracy is entirely modern, and must in a considerable degree arise from similarity of form being very nearly preserved in the different species of casks.

The great variety of cases which occur would make a summary inconveniently long. Wherever a content is to be found, either the figure itself is simple and regular, as in the case of a cylinder, or nearly a simple figure, as in the case of some casks, which may be considered as the frusta of spheroids [See BARREL as an instance of the approximating supposition], or so irregular that the content can only be found by dividing them into a considerable number of sections, and considering each section as a small cylinder or frustum of a cone. [QUADRATURES, METHOD OF.]

The work on gauging, which is most commonly used, is Symon's 'Practical Gauger,' which has been through several editions. Other works are, those of Leadbetter, Shirtcliffe, Moss, Gutteridge, and Hey. The first three are of the first half of the last century, and that of Shirtcliffe contains theoretical investigations. Ward's 'Mathematician's Guide,' and Hutton's and Bonnycastle's 'Mensuration,' contain small treatises on the subject.

GAUL. [FRANCE.]

GAULNA. [CANDEISH, vol. vi., p. 233.]

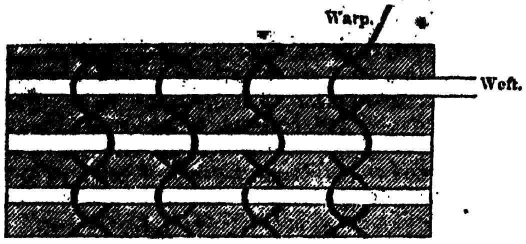
GAULS. [CELTÆ; FRANCE.]

GAURS. [GUEBRES.]

GAUZE, a light transparent texture, made of fine silken threads. Its name has led to the conjecture that this fabric was first invented in Gaza, a city of Palestine. Spitalfields was, some years back, the principal seat of the silk-gauze manufacture in Great Britain; but of late Paisley and Glasgow and their vicinities have almost entirely engrossed

this manufacture, and it is now nearly discontinued in London.

Gauze is one of the very few silken fabrics in the making of which the British manufacturer is still excelled by the French, both as to cheapness and quality. This cheapness results from the lower rate of wages paid to the French weavers as compared with ours; since the weight of silk contained in a yard of gauze is so trifling as to make the value of the material bear but a small proportion to that of the labour employed in its conversion.



The texture of gauze is different from that of plain weaving, in which the warp, or longitudinal threads, are always parallel to each other: the essential character of gauze-weaving is that between each cast of the shuttle a crossing of the warp threads shall ensue, and thus the weft (which forms the cross-threads interlaced by the warp) is not brought into absolute contact with the cross-thread immediately preceding. The intervals left between the interlacings cause that degree of transparency which, without such arrangement, could only result from a looseness of texture, incompatible with beauty and utility.

GAUZOU-POUCO, or Guazapuco Deer. [Deer, vol. viii., p. 361.]

GAVELKIND, a customary tenure existing at this day in the county of Kent only. It seems that this tenure was the common socage tenure among the Anglo-Saxons (Glanvil, l. 7, c. 3), and the reason of its continuance in Kent has been ascribed to the resistance which the inhabitants of the county made to the Norman invaders. This tenure also prevailed in Wales until the 34th Henry VIII., when it was abolished by statute. Various derivations of the term Gavelkind have been suggested: that adopted by Sir Edward Coke and his contemporaries was, *gave all kinde*, from the consequences of the tenure—an etymology worthy of Coke. But that generally received at the present day is from the Saxon *Gavel* (Rent); Gavelkind, that is, land of such a kind as to yield rent. A very elaborate examination of the several proposed derivations is given in the 1st chapter of Robinson's 'Treatise on Gavelkind.' The chief distinguishing properties of this tenure are: 'That upon the death of the owner without a will the land descends to all the sons in equal shares, and the issue of a deceased son, whether male or female, inherit his part; in default of sons, the land descends in equal shares to the daughters; in default of lineal heirs, the land goes to the brothers of the last holder; and in default of brothers, to their respective issue.'

The tenant may aliene at 15 years of age, by means of a feoffment [Feoffment], and the estate does not escheat in case of an attainder and execution, the maxim being, 'the father to the bough, the son to the plough.' The husband is tenant by curtesy of a moiety of his wife's lands, without having any issue by her; but if he marries again, not having issue, he forfeits his curtesy. A wife is endowed of a moiety of the lands of which her husband died seised, not for life as by the common law, but during chaste widowhood only. Gavelkind lands were generally devisable by will before the statute of wills was passed.

Several statutes have been passed, at the request of holders of Gavelkind lands, to render them descendible according to the course of the common law, or, as it is called, to disgavel them. These statutes however only alter the partible quality of the customary descent; they do not affect the other incidents to the tenure. And notwithstanding the extent of the disgavelling statutes, it is always presumed that lands in Kent are of this tenure, until the contrary is proved. The names of all the persons whose lands in Kent have been disgavelled may be found in Robinson's *Treatise*, before mentioned, p. 381. This was one of the tenures proposed to be abolished or modified by the Real Property Commissioners in their third Report. (2. Bl. *Com.*; Rob.'s *Gavelk.*)

This tenure existed also in Ireland as an incident to the custom of tanistry—and as such ceased with that custom in consequence of the judgment against it. (Davis's *Reports*, 28.) In the reign of Queen Anne, with the view of weakening the Roman Catholic interest in Ireland, the land of Roman Catholics was made descendible according to the custom of Gavelkind, unless the heir conformed within a limited time; but by the stat. 17 and 18 Geo. III., c. 49 (Irish), the lands of Catholics are made descendible according to the course of the common law. (Robinson, p. 21.)

This customary descent is followed in some manors, particularly in the manors of Stepney and Hackney. (See the custumal of those manors printed in 2 Watkins, *Copyh.*, 508.)

GAVIAL. [Crocodile, vol. viii., p. 167.]

GAVOT (*Gavotta*, Ital., *Gavotte*, Fr.), a lively dance of two strains, in duple time. This generally followed the minuet, and still succeeds the *Menuet de la Cour*, when the latter is introduced on the stage.

GAY, JOHN, a lively poet of the 18th century, born at or near Barnstaple, in Devonshire, in 1688, began the world as apprentice to a mercer in London. That employment however he soon forsook, and having published his first piece, 'Rural Sports,' in 1711, he dedicated it to Mr. Pope, and thus established an acquaintance which ripened into a firm and lasting friendship. In 1712 he became secretary to the Duchess of Monmouth, whose service he quitted in 1714, to attend the Earl of Clarendon, ambassador to Hanover, in a similar capacity. This was his introduction to a court life. He sought and obtained the favour of the Prince of Wales, but was neglected after that prince's accession to the throne: and the disappointment of his ambition he took so seriously to heart, that it appears to have had great effect in shortening his life. This was a great weakness, for Gay ought to have possessed in himself every requisite for comfort. His writings had been lucrative, and his wit, united with the simplicity and suavity of his temper, had secured to him a large circle of attached friends, both of the noble and the witty. But his spirits were easily elated and easily depressed; and an indolent improvident temper prevented him from making the best of the advantages which he possessed. The latter years of his life were spent in the household of the Duke of Queensberry, where he was treated with great kindness and respect. He died December 4, 1732, and was buried in Westminster Abbey, where a monument, with an affectionate inscription by Pope, is erected to him.

Gay wrote several comedies and farces, of which we need only mention a mock-heroic piece, the 'What d'ye call it,' which had a great run in 1715, and may still be read with amusement; and the celebrated 'Beggar's Opera,' which was brought on the stage in November, 1727, and was acted for 63 following days during that season, besides obtaining similar popularity in other places. The rest of his dramas have been long forgotten. His Fables, written with liveliness and elegance, are still popular with the young. The second part of them is of a political turn, and was written for the use of the infant Duke of Cumberland, in 1726. The 'Shepherd's Week' is a series of pastorals, written, it is said, in rivalry of Ambrose Philips, and representing rural life in its true character of poverty and rudeness, instead of in the false colours of romance. 'Trivia, or the Art of Walking the Streets of London,' shows talent for observation, and is a clever and spirited example of the mock-heroic. Of his minor pieces, the favourite ballad of 'Black Eyed Susan' is a good specimen. (Johnson's *Lives*; *Biog. Dict.*)

GAY-LUSSITE, a mineral so named in honour of the distinguished French chemist; it occurs in imbedded crystals; the primary form is a right-rhombic prism. Cleavage parallel to the lateral planes, distinct. Fracture conchoidal. Hardness 2·5. Very brittle and easily reduced to powder. Colour white or dirty white. Colour of the powder grey. Lustre vitreous. It is translucent or transparent, and doubly refractive. Specific gravity, 1·93 to 1·99.

It is slightly soluble in water; when heated it loses water; and before the blowpipe it fuses readily into an opaque globule, which has alkaline properties. Found in a thin stratum of soft clay covering a bed of sesquicarbonate of soda called *urao*, at the bottom of a lake near Lagunilla in Colombia.

Analysis according to Boussingault;—

Carbonic acid	28·66	
Soda	20·44	
Lime	17·70	
Water	32·20	
Alumina	1·	
		100·

GAYA. [BAHAR.]

GAZA, now called Gazara, a town of Syria, or more properly speaking, of Palestine, on the S.W. frontiers of that country, near the borders of the desert which separates it from Egypt. It consists of the upper town, with a castle situated on a hill, about two miles from the sea, and a lower part, or suburb, in the valley below. The population is between 3000 and 4000. It has some manufactories of soap and cotton stuffs, and carries on some trade by sea, especially with Egypt, and also by land through the desert with Suez. Gaza is greatly fallen from its antient splendour; but it still exhibits signs of commercial activity and prosperity. It is repeatedly mentioned in Holy Writ, especially in Judges (c. xvi.), as one of the principal towns of the Philistines. It was besieged by Alexander the Great, and taken after an obstinate defence. It was afterwards destroyed by Alexander Jannæus, about 98 B.C., and forty years after was rebuilt by Gabinius, the Roman governor of Syria. The town was afterwards destroyed by the Jews in one of their revolts against the Romans; in the Acts of the Apostles (viii. 26), it is mentioned as being then deserted. It was however rebuilt, and is mentioned as a town of some consequence under Constantine, who gave it the name of Constantia. At a later period we find it mentioned in the wars of the Crusades. The traveller Sandys gives a good description of Gaza as it was towards the beginning of the 17th century, when there were still many remains of antient buildings, marble and granite pillars, &c. The hill upon which Gaza stands is about two miles in circumference at the base, and appears to have been once wholly enclosed by walls. The town being surrounded by gardens and plantations of olive and date trees, above which numerous and elegant minarets rise, has a pleasing appearance from a distance. The country around, which is hilly, is remarkably fertile. (Jolliffe's *Letters from Palestine*; Irby and Mangles' *Travels*; Richardson.)

GAZA, THEODORE, a learned Greek scholar, born at Thessalonica in the early part of the 15th century, emigrated to Italy, like others of his countrymen, at the time of the fall of the Eastern Empire. He found liberal patrons in his countryman Cardinal Bessarion, Pope Nicholas V., and King Alfonso of Naples. Gaza translated into Latin 'Aristotle's History of Animals;' the 'History of Plants,' by Theophrastus; the 'Aphorisms' of Hippocrates, and other Greek works. He also wrote a Greek Grammar, which was published at Rome in 1495, and was often reprinted. He was one of those who contributed powerfully to the revival of classical studies in Italy. Although he wrote in praise of Aristotle's opinions, and therefore on the same side as Georgius of Trebizond, in the then pending controversy concerning the comparative merits of Aristotle and Plato [BESSARION], yet his mildness and modesty kept him within the bounds of decorum, and he thereby became obnoxious to the more violent Georgius, who assailed him with invectives. Gaza died at Rome, or, as some say, in Calabria, at an advanced age. He wrote also a book on the 'Origin of the Turks,' and a treatise 'De Mensibus Atticis.'

GAZELLE. [ANTELOPE, vol. ii., p. 83.] Mr. Ogilby (1836) has elevated *Gazella* to the rank of a genus among his *Capridæ*; Type, *Gazella Dorcas*, *Antilope Dorcas* of authors. [GOAT.]

GAZETTE (*gazzetta* in Italian, *gaceta* in Spanish) is the name given to newspapers in several parts of the Continent. The name was, according to Ménage and others, derived from a small Italian coin, which was the price of the first newspaper established in that country. In England the London Gazette is an official newspaper, containing the proclamations, orders in council, promotions, bankruptcies, &c.

Gazetteer has been used in England to mean a geographical dictionary, such as Brookes' 'General Gazetteer,' and other similar works. [DICTIONARY.]

GEBERS. [GUEBRES.]

GEBHARDI, a German author, born in 1699 at Brunswick, died at Lüneburg in 1764. His most important work is a 'Universal Genealogy,' published in 1730-31, in German; it is divided into three volumes, each with a particular title; the first contains the pedigree of the sovereign houses of Europe which existed in 1731; the second, the pedigrees of the dynasties that were already extinct at that time; the third, the genealogy of Mohammedan and heathen monarchs. This production served as a basis to all the genealogical works published by the Germans during the eighteenth century. Gebhardi also wrote 'Historical and Genealogical Memoirs,' 3 vols., 8vo. His son published, after his father's death, a collection of materials for a genealogical history of the reigning families of Germany, which was left in manuscript by Gebhardi.

GE'BIA, GE'BIOS. [THALASSINA.]

GECARCI'NUS, Dr. Leach's generic name for those brachyurous decapod crustaceans known familiarly to the English as *Land-crabs*, and to the French by the appellations of *Tourlouroux*, *Crabes peintes*, or *Crabes violets*, some of these terms being applicable not only to different species, but to the same species at different ages, so that those various names cannot be depended upon as specific designations.

Latreille placed this tribe of crabs immediately after *Pinnotheres*. He seems to admit *Plagusia* and *Grapsus* into the same section with the Land-crabs, properly so called; and next to *Grapsus* come the *Orbiculata* (his fourth section), containing *Corystes*, &c.

Desmarest places *Gecarcinus* at the head of the *Quadrilatères* of Latreille, and arranges all the true Land-crabs under that generic title, which is preceded by *Pilumnus*, and succeeded by the *Orbiculata* of Latreille.

M. Milne Edwards makes the *Gecarcinians* the second tribe of his family of *Catametopes*; and in his arrangement they stand between the *Thelphusians*, the first tribe, and the *Pinnotherians*, the second tribe of that family.

According to the last-named author the tribe of *Gecarcinians* is one of the most remarkable groups of the class *Crustacea*; for it is composed of animals breathing by means of branchiæ, or gills, and yet essentially terrestrial, so much so indeed, that they would perish from asphyxia if submerged for any length of time. They may be distinguished easily from the rest of the family by their nearly oval carapace, which is much elevated and convex above. The branchial regions are in general very distinct, and project much below, occupying nearly two-thirds of the surface. The front is very nearly as large as the buccal frame (*cadre buccal*), and strongly curved below. The orbits are suboval, moderate, and very deep. The lateral borders of the carapace are very much arched, and generally describe a semicircle. The *internal antennæ* are lodged under the front, and fold back transversely in narrow and often nearly linear excavations. The disposition of the external antennæ varies, and so do the jaw-feet (*pates-mâchoires*); sometimes the fourth joint is inserted at the external angle of the preceding, and remains exposed, as in the *Ocypodians*, and sometimes it is entirely hidden under its internal surface. The *feet* of the first pair are long and strong; the succeeding feet are robust and long, and very nearly equal in size, and their tarsus is pointed and quadrilateral. The *abdomen* of the *male* is received in a deep excavation of the sternal *plastron*, and its second articulation reaches nearly always to the base of the posterior feet. It is in general so long that it comes up to the base of the mouth, and the appendages hidden beneath it are remarkably large. The branchiæ are generally seven in number, viz., five fixed to the vault of the sides, and two, in a rudimentary state, hidden under the base of the preceding, and taking their origin from the jaw-feet; but in some species there are nine on each side. The respiratory cavity is very large, and is raised into a vault highly elevated above the branchiæ, so that above those organs there is a large empty space. The tegumentary membrane with which it is lined is also very spongy, and sometimes forms a fold along the lower edge of the cavity, so as to form a kind of gutter, or longitudinal trough for containing water when the animal remains exposed to the air. (Milne Edwards.) Observations on this curious reservoir were communicated to the Royal Academy of Sciences in France by MM. Audouin and Milne Edwards some years ago, wherein the authors show that in all the crustacea the branchiæ are fitted to perform the functions of respiratory organs in the air as well as in the water; that the more or less rapid death of the aquatic species, when exposed to the air, depends upon various causes, of which one of the most direct is the evaporation from the

branchiæ, which produces their desiccation; that consequently one of the conditions necessary to the support of life in animals which have branchiæ, and live in the air, is the having these organs defended against desiccation; and lastly, that these dispositions actually occur in the Land-crabs, which all possess various organs destined for absorbing and keeping in reserve the quantity of moisture necessary for maintaining a suitable degree of moisture in the branchiæ.*

Geographical Distribution, Habits, Reproduction, &c.—The Land-crabs, or Gecarcinians, inhabit the warm countries of the New and Old World, and Australasia; but as far as observation has hitherto gone, America and its islands seem to be the places where the form is most highly and most numerously developed. Almost every writer on the Natural History of the countries last mentioned treats largely on the habits of these creatures, and in the works of Rochefort (*Histoire Naturelle des Antilles*), De Feuillée (*Observations faites sur les Côtes d'Amerique*), De Labat (*Nouveau Voyage aux Isles d'Amerique*), Sloane (*Natural History of Jamaica*), Browne (*Civil and Natural History of Jamaica*), Hughes (*Natural History of Barbados*), Catesby (*Natural History of Carolina*), &c. &c., will be found details more or less ample, and highly interesting, of their manners; though most of the writers do not determine the species sufficiently to enable us to judge of what particular Land-crab they are writing. All these authors will however well repay the trouble of consulting them.

Latreille sums up what he considers the credible parts of these narratives thus:—The crabs pass the greatest part of their life on land, hiding themselves in holes, and not coming forth till evening. Some keep about cemeteries. Once a year, when they would lay their eggs, they assemble in numerous bands, and move in the shortest direction to the sea, without caring for any obstacles. After they have finished their deposit they return much weakened. It is said that they block up their burrows during their moult; and while they are undergoing this operation, and are still soft, they are called *Boursiers* (Purse-crabs), and their flesh is then much esteemed, although it is sometimes poisonous. This quality is attributed to the fruit of the manchineel, of which the people think, falsely perhaps, that the crabs have eaten.

The reader will find under the article BIRGUS some extracts giving an account of the moulting of the Land-crabs, and showing that they are then called *Crabes Boursières*, in the attempt to point out that Linnæus was misled in supposing the true Purse-crabs to be inhabitants of the Antilles, on the authority of Rochefort (vol. iv., p. 433). With regard to the alleged want of foundation for the story of the Land-crabs being sometimes poisonous, in consequence of what they have eaten, there are so many testimonies to the fact, that it will be a fault on the right side to be cautious. Thus Sloane, who praises (as who does not?) their delicacy of taste, says, 'They are thought to be poysonous when they feed on the Mansanilla-tree leaves or fruit, which I suppose may come from some of it sticking to their chaps, or lying undigested in their stomachs, which are not separated before eating.' Catesby writes, 'Some are black, some yellow, some red, and others variegated with red, white and yellow mixed. Some of these, as well as of the fish of this country, are poisonous: of which several people have died, particularly of the black kind: the light coloured are reckoned best, and when full in flesh are very well tasted. In some of the sugar islands they are eat without danger, and are no small help to the negro slaves, who on many of the islands would fare very ill without them. They feed on vegetables.' Hughes, speaking of the 'large white land-crab,' and its feeding on grass, &c., remarks, 'They likewise often feed upon manchineel apples, as well as upon the leaves or berries of poison-trees. At such times they are dangerous to be eaten, unless very great care be taken to wash the fat, as well as the other meat on the inside, with lime-juice and water.' He says the same in effect of 'the Mulatto Crab.'

M. Milne Edwards thus gives his summary:—The greater number ordinarily haunt humid places, and hide themselves in holes which they excavate in the earth, but the localities preferred by them vary with the species. Some live in the low and marshy lands near the sea, others on the wooded hills far from the shore; and at certain epochs, these last quit their habitual dwelling to go to the sea. It is even reported that then these crustaceans unite in great bands and thus make very long journeys without suffering themselves to be stopped by any obstacle, and laying waste everything in their route. Their principal food consists of vegetable substances, and they are nocturnal or crepuscular in their habits. It is more particularly in the rainy season that they quit their burrows, and they run with great rapidity. It would appear that it is at the time of laying that they go to the sea and there deposit their eggs, but we know of no decidedly positive observation on this point. During their moult they remain hidden in their burrows. (*Hist. Nat. des Crustacés.*)

We select Browne's account of the habits of the 'black or mountain crab' (*Cancer Ruricola*, Linn.), because he resided many years in the Island of Jamaica, and seems to have lost no opportunity of making personal observations. 'These creatures are very numerous in some parts of Jamaica, as well as in the neighbouring islands, and on the coast of the main continent; they are generally of a dark purple colour, but this often varies, and you frequently find them spotted, or entirely of another hue. They live chiefly on dry land, and at a considerable distance from the sea, which however they visit once a year to wash off their spawn, and afterwards return to the woods and higher lands, where they continue for the remaining part of the season; nor do the young ones ever fail to follow them as soon as they are able to crawl. The old crabs generally regain their habitations in the mountains, which are seldom within less than a mile, and not often above three from the shore, by the latter end of June, and then provide themselves with convenient burrows, in which they pass the greatest part of the day, going out only at night to feed. In December and January they begin to be in spawn, and are then very fat and delicate, but continue to grow richer until the month of May, which is the season for them to wash off their eggs. They begin to move down in February, and are very much abroad in March and April, which seems to be the time for the impregnation of their eggs, being then frequently found fixed together; but the males about this time begin to lose their flavour and richness of their juices. The eggs are discharged from the body through two small round holes situated at the sides, and about the middle of the under shell; these are only large enough to admit one at a time, and as they pass they are entangled in the branched capillaments, with which the under side of the apron is copiously supplied, to which they stick by the means of their proper gluten, until the creatures reach the surf, where they wash them all off, and then they begin to return back again to the mountains. It is remarkable that the bag or stomach of this creature changes its juices with the state of the body; and while poor is full of a black, bitter, disagreeable fluid, which diminishes as it fattens, and at length acquires a delicate rich flavour. About the month of July or August the crabs fatten again and prepare for mouldering, filling up their burrows with dry grass, leaves, and abundance of other materials: when the proper period comes each retires to his hole, shuts up the passage, and remains quite inactive until he gets rid of his old shell and is fully provided with a new one. How long they continue in this state is uncertain, but the shell is observed to burst both at the back and sides to give a passage to the body, and it extracts its limbs from all the other parts gradually afterward. At this time the fish is in the richest state, and covered only with a tender membranous skin, variegated with a multitude of reddish veins, but this hardens gradually after, and becomes soon a perfect shell like the former; it is however remarkable that during this change there are some stony concretions always formed in the bag, which waste and dissolve gradually as the creature forms and perfects its new crust. A wonderful mechanism! This crab runs very fast, and always endeavours to get into some hole or crevice on the approach of danger; nor does it wholly depend on its art and swiftness, for while it retreats it keeps both claws expanded, ready to catch the offender if he should come within its reach, and if it succeeds on these occasions it commonly throws off the claw, which continues to squeeze with incredible force for near a minute after; while he, regardless of the loss, endeavours to make his escape and to gain a more secure or a more lonely covert, contented to renew his limb with his coat at the ensuing change; nor would it grudge to lose many of the others to preserve the trunk entire, though each comes

* 'De la Respiration aérienne des Crustacés, et des modifications que l'appareil branchial éprouve dans les crabes terrestres.'

off with more labour and reluctance, as their numbers lessen.'

Thus much of the habits of the Land-crabs of the New World. The late bishop Heber in his 'Narrative' gives an account of some Land-crabs in India, living at a great distance from the sea, and obstructed by great obstacles in their passage to it. 'The plain of Poonah,' writes the Bishop, 'is very bare of trees, and though there are some gardens immediately around the city, yet as both these and the city itself lie in a small hollow on the banks of the river Moola, they are not sufficiently conspicuous to interrupt the general character of nakedness in the picture, any more than the few young trees and ornamented shrubs with which the bungalows of the cantonment are intermingled. The principal and most pleasing feature is a small insulated hill immediately over the town, with a temple of the goddess Parvati on its summit, and a large tank (which, when I saw it, was nearly dry) at its base. All the grass-land round this tank, and generally through the Deckan, swarms with a small land-crab, which burrows in the ground, and runs with considerable swiftness, even when encumbered with a bundle of food almost as big as itself. This food is grass, or the green stalks of rice, and it is amusing to see them sitting as it were upright, to cut their hay with their sharp pincers, then waddling off with the sheaf to their holes as quickly as their sidelong pace will carry them.' Upon this passage Mr. Broderip observes, that when we call to mind the position of Poonah, and read of the neighbouring river and tank, we may feel inclined to ask whether the river or the tank might not be the scene of ovipositing; and, he adds, that it is not improbable that there may be a race of land-crabs appropriated to continental or even insular situations out of reach of the ocean, and that fresh water may be as necessary to their reproduction as sea water is to the land-crabs of the West Indies. Such a supposition, he thinks, is in unison with the bountiful provisions of nature for the general diffusion of animal life. (*Zool. Journal*, vol. iv.)

Mr. Westwood in his interesting paper 'On the supposed existence of Metamorphoses in the Crustacea' (*Phil. Trans.*, 1835), notices the abdomens of several female crabs having the interior surface covered with hundreds of eggs or newly-hatched young, which were in the collection of the late Rev. Lansdown Guilding. One of the bottles in which one of these was deposited was labelled by the last-mentioned gentleman, 'Eggs and young of a Land-crab not undergoing Metamorphosis.' From this specimen Mr. Westwood obtained eggs, and young crabs evidently just hatched, and others at a rather later stage of their growth. The eggs were of a dark-reddish colour, showing through the outer integument the rudimental limbs of a future animal of a paler colour. On removing the thin transparent pellicle which surrounded one of these eggs, the eyes were most conspicuous, the tail was seen extended as a narrow plate, nearly reaching to the eyes, and along its sides lay the large anterior cheliferous, and the four following simple pairs of limbs. The existing organs, although perfectly discernible, occupied only a small portion of one side of the egg, its greater part being filled with hardened matter composed of minute molecular grains. The animal was in a sufficiently forward state of development not to allow the least doubt to be entertained as to the nature of these limbs, nor did any organs appear answering to the two large split pairs of natatory organs of *Zoëa*. The branchiæ, in a fleshy and unorganized state, were also found at the base of the legs. The eggs were 1½ lines in diameter.

Mr. Westwood gives in his Memoir figures of the egg, and of the young crab in progressive stages of growth. His reputation as an observer is too well founded to allow a doubt of the accuracy of his illustrations and description; and though, it is true, the Rev. Mr. Guilding does not state the species, that lamented gentleman's acquirements are too well known to suppose it possible that he should have mistaken the tribe. Indeed, the subject of the reproduction of Land-crabs was one most likely to attract the attention of a naturalist who devoted so much of his attention to the zoology of the Caribean Islands, and resided so long in one of them. Mr. Westwood's observations, then, appear to embody a conclusive answer to the arguments adduced by Mr. Thompson from the habits of the West Indian Land-crabs; for they show that one species, at least, does not undergo metamorphosis.

Utility to man.—As an article of food some of the Land-crabs, when in season and well nourished, may be considered as combining the qualities of wholesomeness and delicious flavour. We have conversed with men of various tastes who have partaken of this luxurious food, and all agree in describing it as exquisite. Indeed it appears that when simply cooked in its own juices, in its own shell, it requires no condiment but a squeeze of the fragrant lime to make it one of the best of dishes. 'When the black crab (*Gecarcinus Ruricola*) is fat,' says Dr. Patrick Browne, 'and in a perfect state, it surpasses everything of the sort in flavour and delicacy; and frequently joins a little of the bitter with its native richness, which renders it not only more agreeable in general, but makes it sit extremely easy upon the stomach. They are frequently boiled and served up whole; but are commonly stewed when served up at the more sumptuous tables.' Land-crabs have been brought alive to this country. We saw one or two in apparently good health, running about in the Zoological Gardens in the Regent's Park. They were, as well as we recollect, of the species last named, and came from the West Indies. The suggestion may be rather hard upon the West Indians; but why, may we ask, are not these crabs imported for our tables as regularly as turtle? Barrels with grass and other vegetables, such as they are generally kept in, when there is no better convenience, in their native country, would not take much room on deck; and if the crabs were collected at the proper time and allowed sufficient moisture and only sufficient to keep them in health, an ordinary voyage would bring them to us, most probably, in very fair condition.

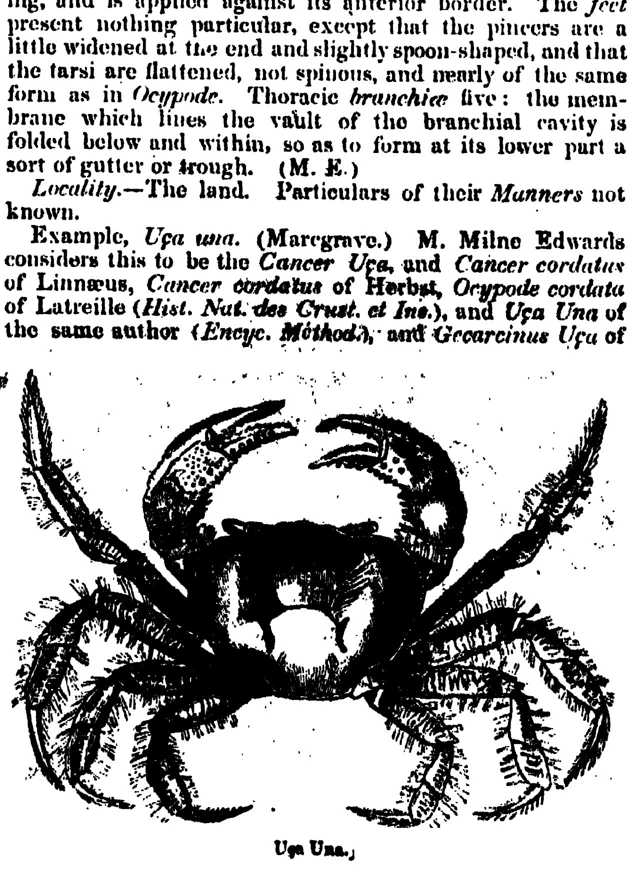
M. Milne Edwards separates the Gecarcinians into the following genera:—

Uça. (Latreille.)

Generic Character.—*Carapace* much wider than it is long, of a suboval shape, and very much elevated. *Front* narrower than in the other Gecarcinians, very much inclined and nearly semicircular. *Orbits* rather large, and open externally below their external angle. *Anterior fossettes* suboval, small, and separated by a small triangular prolongation from the epistome. The *external antenna* occupies the orbitary internal canthus. The *buccal frame* is of a rhomboïdal form. The second and third joint of the *external jaw-feet* are quadrilateral, nearly of the same size, and terminate on the internal side by a straight border. The fourth joint is inserted at the external angle of the preceding, and is applied against its anterior border. The *feet* present nothing particular, except that the pincers are a little widened at the end and slightly spoon-shaped, and that the tarsi are flattened, not spinous, and nearly of the same form as in *Ocypode*. Thoracic *branchiæ* five: the membrane which lines the vault of the branchial cavity is folded below and within, so as to form at its lower part a sort of gutter or trough. (M. E.)

Locality.—The land. Particulars of their *Manners* not known.

Example, *Uça una.* (Marcgrave.) M. Milne Edwards considers this to be the *Cancer Uça*, and *Cancer cordatus* of Linnæus, *Cancer cordatus* of Herbst, *Ocypode cordata* of Latreille (*Hist. Nat. des Crust. et Ins.*), and *Uça Una* of the same author (*Encyc. Méthod.*), and *Gecarcinus Uça* of



Uça Una.

Lamarck. He observes, that M. Latreille cites his *Ocypode fossor* as one of the synonymes of *Uça Una*, but that he (M. Milne E.) is inclined to believe that it is rather referrible to *Uça lævis*.

Description of *Uça Una*.—Lateral edges of the *carapace* furnished with a small projecting and finely dentilated crest. *Pterygostomian regions* very granulous. *Manus* spiny above and within. *Feet* hairy below, moderate in length; the third pair rather longer than the others. Size two inches (French). *Locality*, South America.

Cardisoma. (Latreille.)

Generic character.—*Carapace* more elevated and square than in the greater part of the same tribe. *Buccal frame* in the shape of a long squared figure, with its lateral edges straight. The second joint of the *external jaw-feet* narrowed anteriorly, and the third, which is a little shorter than the preceding, widening from behind forwards, so that these organs leave between them, in the middle of the buccal apparatus, a wide space with nearly the form of a lozenge; the third joint, which is nearly cordiform, is notched on its anterior border and gives insertion at its external angle to the fourth joint, which like the succeeding ones always remains exposed. *Front* very large and nearly straight. *Antennary fossettes* transversal and separated by a semicircular and very wide surface. *Feet* of the third and fourth pairs longest; the *tarsi* quadrilateral and very spiny. *Branchiæ* placed under the vault of the sides, seven on each side, the first being ordinarily very small and the two last very long.

Locality; Habits.—The species of this genus live in the woods and dig deep and oblique holes whence they come not forth except at night. (M. E.)

Example, *Cardisoma Carnifex.*—This, according to M. Milne Edwards, is the *Cancer Carnifex* of Herbst; *Ocypode cordata*, *Gecarcinus Carnifex*, and *Cardisoma Carnifex* of Latreille, and he cites also *Gecarcinus hirtipes* of Lamarck, as a synonyme, but with a query.

Description of *Cardisoma Carnifex.*—Carapace very much elevated and its surface very much curved from before backwards, but nearly horizontal transversely: its lateral edges marked by a projecting and elevated line. A small tooth behind the external orbitary angle. Four rows of spines upon the *tarsi*; the two lower not numerous. *Pincers* large on one side; *Manus* very large; *fingers* touching nearly throughout their length. Length two inches (French). (M. E.)

Locality.—The neighbourhood of Pondicherry.

Cardisoma Carnifex.

Cancer Hydromus of Herbst, in the opinion of M. Milne Edwards, is evidently a species approximating closely to the preceding, if indeed it can be distinguished from it.

Cardisoma Guanhumi, which inhabits the Antilles, is more than three inches in length, and the claws of the male are larger than the body, very much curved, and not touching except at their extremity.

Gecarcoïdea.

Carapace more oval and less elevated than in the preceding genera. *Front* of moderate length, straight, and very much inclined. *Antennary fossettes* rounded and separated by a small triangular prolongation of the front. *Orbits* small; their inferior border much less projecting than in the preceding genera, and leaving between its internal angle and the external antenna a large and deep notch. *Buccal frame* not so clearly circumscribed as ordinarily, and rather circular than square. *External jaw-feet* with a wide space between them; their third joint much less than the second, nearly quadrilateral, little or not at all narrowed backwards, and deeply notched at its anterior edge, at the middle of which is inserted the succeeding joint, which is exposed.

Example, *Gecarcoidea Lalandii.*—Carapace inclining to oval and without a crest on its lateral edges. Feet strong; pincers large, cylindrical, tuberculous, and touching throughout their length; anterior edge of the arms nodulous; succeeding feet dentilated on the edges, those of the third pair the longest. Six rows of dentations on the tarsi. Colour brownish-red. Length rather more than three inches. (M.E.)

Locality, Brazil.

Gecarcinus.

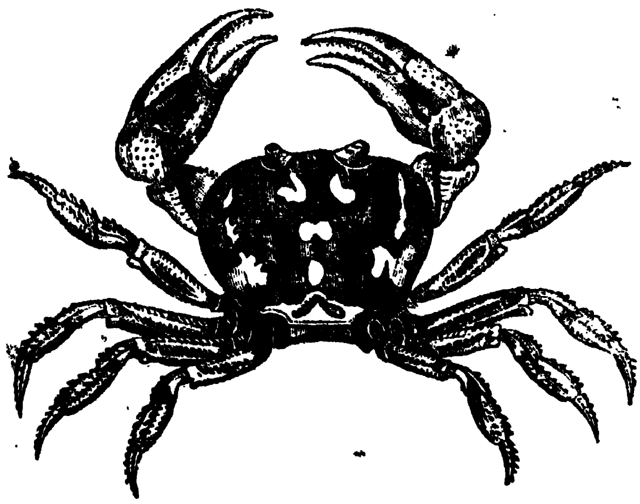
Carapace not much elevated, but very convex on the sides. *Front* very strongly curved below. *Orbits* deep, inclining to oval, and without a notch on the external side. *Internal Antennæ* nearly hidden under the front, which has a small prolongation that goes to join the epistome. The disposition of the *external antennæ* and that of the canthus of the orbit nearly the same as in the preceding genus. *Buccal frame* nearly circular and not clearly separated from the pterygostomian regions. *External jaw-feet* very wide, but with a space between them; their second joint completely covers the succeeding joints, which are inserted on its internal surface. The external appendage of these organs is hidden under their second joint and its extremity scarcely overpasses it. *Feet* presenting nothing remarkable, excepting that their edges are armed with spiniform teeth.

Localities.—The Antilles; Australasia.

Example, *Gecarcinus Ruricola*; *Cancer Terrestris*, Seba; *Cancer Ruricola*, Linn.; *The Land-Crab*, Sloane; *The Black* or *Mountain-Crab*, Browne; *Crabe violet ?* Labat.

Description.—Tarsi armed with six rows of spiniform teeth. Internal edge of the third joint of the jaw-feet without any remarkable fissure. Carapace very large. A few teeth on the internal edge of the carpus. Length rather more than three inches. Colour purplish or reddish-violet, or yellow washed with red. (M. E.)

Locality, the Antilles.



Gecarcinus Ruricola.

Fossil Gecarcinians?

M. Desmarest, in his *Histoire Naturelle des Crustacés fossiles*, describes and figures a species which he notices as being sufficiently common in collections, under the name of *Gecarcinus trispinosus*. The same author, in his *Considérations Générales sur la classe des Crustacés*, alludes to this figure and description, and observes that he has arranged the fossil, with doubt, under the genus *Gecarcinus*. M. Milne Edwards (*Histoire Naturelle des Crustacés*) expresses his belief that this fossil is not a Gecarcinian, and says that it would appear, from the form of the carapace, to approximate more to the genus *Pseudograpsus*.

GECKO, GECKO-FAMILY, GECKOTIDÆ, a natural family of Saurians.

Their head is wide and flattened, with the mouth wide; the nostrils are distinct and lateral; the eyes large, hardly surrounded by short lids, the lower edge of which in the greater number of species does not project outwards, the pupil sometimes rounded, but most frequently dentilated, linear, and lightly fringed; and the auditory opening bordered with two folds of the skin. The teeth are small, equal, compressed, sharp at the point, entire, and planted in the internal edge of the jaws: there are none on the palate. The tongue is short, fleshy, capable of but little elongation, and free at its extremity, which is either rounded or flattened, or very slightly notched.

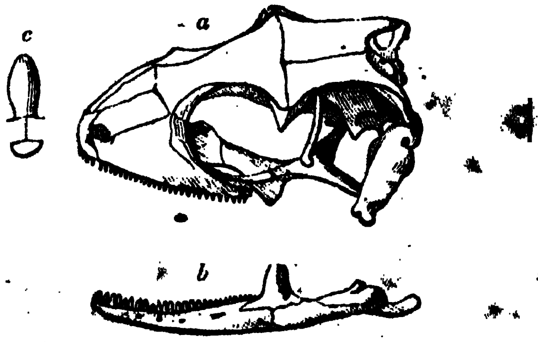
Their neck is apparently little, in consequence of the width of the back part of the head and the squareness of the shoulders. Their body is thick and short, depressed, and low on the legs, with a belly flat below, dragging on the ground, and largest in the middle. There is no crest on the back. The tail varies, but is not long, and often has folds or circular depressions, but never a dorsal crest.

The feet are short, nearly equal in length, wide apart, and robust; the toes nearly equally long, most frequently flattened below, widened, and furnished with transverse, imbricated plates; the nails vary, but they are ordinarily hooked, sharp, and retractile. The conformation of the feet enables the Geckos to run with ease on the smoothest surfaces in every direction, or to remain stationary on them with the back downwards, after the manner of a common house-fly.

The skin is defended by equal granular scales, most frequently interspersed with other tubercular scales, the points blunt or angular. There are femoral pores or pores in front of the vent, on the same line in the majority of species, and, most frequently, in the males only. The limbs and sides are sometimes bordered with fringed membranes.

Organization.

Skeleton.—The skull of the Geckotidæ is marked by some peculiar characters. The bones are well defined, nor do the sutures seem to be obliterated by age. In general contour it approaches the skull of the *Crocodilidæ* by its width, its flatness, and its length; its particular resemblances to the same part in that family are to be found in the disposition of the orbits and in the articulation of the jaws. The excavations for the eyes are very large and apparently incomplete, inasmuch as the orbital frame is not entirely bony in its back part, nor has it, so to speak, any flooring, so that when deprived of the softer parts the cavity communicates with the mouth. The articulation of the jaw is quite backwards, and the *os quadratum* or interarticular bone is wide, short, and hollowed on its posterior surface, for the purpose of receiving the muscle whose office it is to open the jaws and keep them open. The skull differs from that of the other lizards generally in the extreme smallness of the jugal and temporal bones, and in having the parietal bones divided longitudinally into two.



Skull of Gecko: *a*, cranium; *b*, lower jaw; *c*, a tooth enlarged. (Cuv. Oss. Foss.)

The vertebræ vary in number, and, according to Meckel, their body is hollowed into two conical cavities, very nearly like those of fishes: the spinal column is without any spinous processes or projections. The three or four first cervical vertebræ only are without false ribs or transverse articulated apophyses. These are gradually developed, and go on increasing in length and curvature to the fifth or seventh, but none of them are actually joined to the great anterior portion of the sternum. Those which follow reach and are articulated with that bone. They are succeeded by the free or abdominal ribs, which nearly equal in number the vertebræ which precede the pelvis, at least in the *Banded Gecko*.

The sternum in the *Common Gecko* (*Platydactylus guttatus* of Cuvier; *Gecko verus* of Merrem and Gray) consists of a very solid plate, which receives anteriorly and laterally in two angular notches the coracoïd bones, which are wide and delicate, and the clavicles, which are narrow, elongated, and flattened, more especially at their sternal extremity. The rhomboïd and backward portion of this sternal plate affords attachment on the two posterior facings to three pairs of ribs. From the posterior or abdominal angle of this bone two small parallel bones or sternal prolongations are given off, along which three other pairs of ribs are affixed by ligaments. After these six pairs of sternal ribs come seven other pairs, which are curved at their free or abdominal extremity into an obtuse angle, so that they are at this end directed forwards without any junction to a mesial line as in the Chameleons. M. Duméril says that generally he has only counted seventeen ribs; but he observes that there are twenty-four in the *Banded Gecko* (*Platydactylus vittatus* of Cuvier; *Gecko vittatus* of authors). Hence M. Duméril concludes that the number of ribs varies according to the species.

The caudal and pelvic vertebræ require notice. The articulation of the former is either weak, or the body of the vertebra itself is apt to break in the middle, so that a slight effort separates them, and many individuals consequently lose their tails. When these are regenerated, cartilage is generally found in the place of the former bone, and the tail then presents a variety of forms.

The bones of the limbs do not differ from those of the other Saurians so as to require any particular description, with the exception of those of the feet, and there the difference is striking with relation to the greater portion of the class. In the Geckotidæ the bones of the feet are so disposed as to receive the five toes of equal or nearly equal length, and which radiate as it were from a centre so as to form a nearly complete circle; for the external or great toe cannot separate itself from the others to extend itself backwards. The toes are not always furnished with nails; but they are often provided with very remarkable ones, which by their mobility and retractility remind the observer of the organization of the same parts in the cats (*Felidæ*).

Muscular System principally as relating to Locomotion.—The muscles of the *Geckotidæ* are highly irritable, as might be expected in such nimble creatures. Their power of adhering to smooth surfaces makes it necessary that the resistance produced by the adhesion should be instantaneously overcome in case of danger; and we accordingly find that a Gecko which at one moment is fixed motionless to a spot, vanishes as it were in the next from under the hand stretched forth to capture it.

Brain, Nervous System, and Senses.—The brain and nervous system are considerably developed in the *Geckotidæ*, and the greater part of the senses are acute.

Sight.—The orbits, as we have seen, are large and without any flooring or base, and as the eye in this family is very large in proportion to the size of the animal, the projection of the posterior part of the globe may be seen in the inside of the mouth much in the same way as is observable in some fishes. There is scarcely any lid, and what there is is so small that an additional appearance of prominence is given to the eyeball. This lid is simple, circular, and adherent to the globe of the eye by an internal fold. There is a nictitating membrane. Most persons have seen that an epidermic scale which seems to be the external layer of the cornea comes off in serpents with the rest of the skin, and in the Geckos also the integument passes over the front of the eyeball. The eye in such animals never appears humid. M. Jules Cloquet has shown that in the serpents the tears probably are diffused between the epidermic scale and cornea in order to arrive at the nostrils. The pupil is sometimes rounded, but most frequently presents a linear slit, the edges of which are fringed, so that the animal can at its pleasure dilate or diminish the opening through which the light and the images are to be admitted to the retina. Like the cats therefore, the Geckos, though said to be nocturnal in their habits, can also see perfectly well in broad daylight.

Hearing.—The auditory apertures in this family are some

times in the form of slits, sometimes in that of oval or circular holes, and the edges are often rounded and sometimes dentilated. Wagler states that these apertures can be closed in *Ptyodactylus* and *Spheriodactylus*, and it is extremely probable that the rims have a power of approximation generally. The tympanum lies deep, and the auditory cavity communicates with the back of the mouth or throat for the admission of air, as in most pulmoniferous animals. M. Duméril says, that he has proved the sensibility of these animals to the least noises, and that their sense of hearing is very fine.

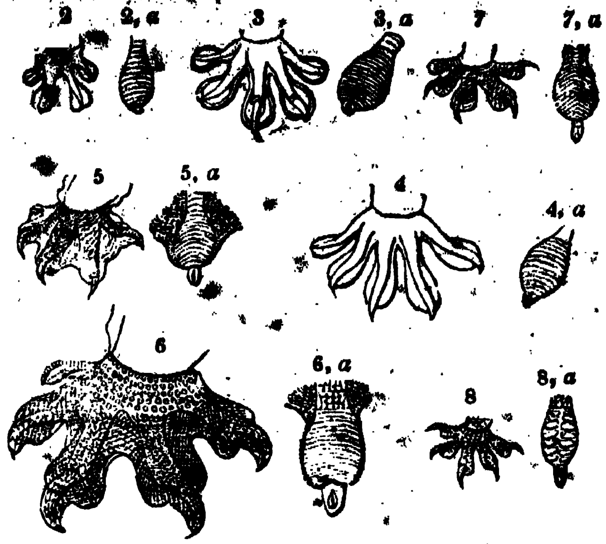
Smell.—The structure of the nostrils in this family would not lead to the conclusion that their sense of smelling is very acute, though it is probably more highly developed than it is in the Frogs.

Taste.—The *Geckotidæ* swallow their prey living, or nearly so, and almost entire, but the presence and form of the teeth render it probable that they can masticate; and this power, combined as it is with the form and structure of the tongue, which is soft, moveable, very fleshy, and furnished with papillæ, seems to indicate a certain degree of the sense of taste.

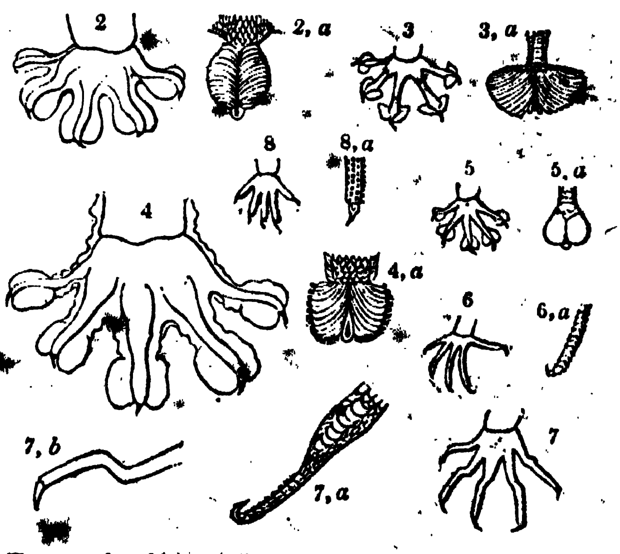
Touch and Integuments.—The skin of the Geckos is generally delicate, and adheres but little to the muscles, from which it is easily detached. In the middle of the back, and sometimes on the sides, granular tubercles rounded on their edges, with others which project at the centre, and are even fashioned into facets, are to be detected in the greater number. When the skin is detached and held up to the light it is seen to be regularly furnished with small delicate, rounded, escutcheon-like bodies, set in the thickness of the skin. The form and distribution of these bodies vary according to the different species in the regions of the belly, of the neck, of the thighs, of the head, and of the tail. M. Duméril, who gives us this information, goes on to state that generally the skin of the *Geckotidæ* is grey or yellowish, but that there are species in which lively colours are disposed on some parts of their bodies, and that it is even said that tints of red, blue, and yellow may be distinguished, which the animal causes to appear and disappear nearly after the manner of the chameleons. Some travellers assured Wagler that certain Indian Geckos became luminous or phosphorescent during the night.

In some of the species the skin is prolonged on the sides of the body and tail into membranes regularly festooned or fringed, and the Geckos generally moult or change their skins at certain periods of the year, when their colours, as is usual in such cases, become brighter. M. Duméril says that he has himself observed this in living individuals captured in their wild state at Cordova, in Spain, in the middle of the summer. There can be little doubt that there is considerable sensibility where the skin is constructed as it is in the Geckos; but, in considering the sense of touch, the curious organization of the feet and toes demands our particular attention. These are the great organs of station or fixation and progression, and the manner in which they perform their office is very interesting. M. Duméril, after referring to Wagler's reflections on this subject in his remarks on the *Platyglossi*, gives his own observations on this part of the organization of the Geckos. He refers to the comparative shortness and general structure of the feet above given, and then proceeds to notice the particular conformation of the toes in the greatest number of species. The lower surface of these, and the sole, are very much dilated, widened, and furnished with small plates or lamellæ, following or overlying each other (lamelles placées en recouvrement) in a regular manner, but in a mode which varies in the different species. The nails, which are sometimes wanting on all the toes, are most frequently pointed, hooked, and more or less retractile, constituting a sort of claws, which remain constantly sharp. The toes are sometimes united at their base, and, as it were, semipalmated. In some of the species, *Ptyodactylus* and *Spheriodactylus* of Cuvier, for instance, the extremity of the toes expands, and widens considerably in form of a fan or semi-disk, as in the Tree-frogs. The same author then alludes to the organization of the feet in certain insects, particularly the *Orthoptera* and *Diptera*, which enables them to maintain an inverted position.

The membranous and soft plates with which the lower surface of the toes of the Geckos are furnished present a variety of modifications in the different genera. Sometimes they are simple, or continued from one edge to the other, and those of this class offer distinctions in the furrows themselves, and in the curves described by the lines which mark them; sometimes they are separated longitudinally by a groove, sometimes they are complete or continued throughout the length, sometimes they exist on the last phalanges only; and, lastly, in the aberrant genera they are hardly distinct. The modifications of this curious apparatus, as well as the absence or presence of the nails, afford the leading characters on which Herpetologists have established the different genera, and we here present the various forms collected by M. Duméril.



Feet and structure of the under part of the toes of *Geckotidæ*. The figure marked with the numeral only, represents the foot; the figure marked with the added letter *a*, represents the structure of the lower part of the toe. 2, Platydactylus Cepedianus; 3, Platydactylus Ægyptiacus; 4, Platydactylus guttatus (Gecko verus, Common Gecko, of Gray); 5, Platydactylus homalocephalus (Ptychozoon, of Kuhl; Pteropleura, of Gray): 6, Platydactylus Leachianus (Ascalabotes Leachianus; Griff., 'Anim. King.'); 7, Hemidactylus Oualensis (Peropus of Wiegmann); 8, Hemidactylus triedrus.



The numerals and letters indicate the same parts as they do in the upper figure, with the exception of 7, *b*, which represents a claw in profile. 2, Thecodactylus Theconyx; 3, Ptyodactylus Hasselquistii (P. guttatus, of Rüppell, House Gecko, Griff., ('Anim. King.'); 4, Ptyodactylus fimbriatus (Gecko fimbriatus of authors; Fimbriated Gecko, Griff., 'Anim. King.'); 5, Phyllodactylus porphyreus; 6, Gymnodactylus scaber (Stenodactylus scaber, of Rüppell; Cyrtodactylus of Gray)? 7, Gymnodactylus pulchellus (Gonyodactylus pulchellus of Wagler; Cyrtodactylus pulchellus, of Gray); 7, *b* represents a claw of the animal seen in profile.

Digestive System.—The numerous teeth of the Geckos are similar in form and length, placed on the same line, and fixed in a longitudinal furrow on the internal edge of the jaw by the external surface of their roots. The enamelled crowns are cutting, and their base is rounded. From their position in the jaw, Wagler has derived his designation *Pleurodonts*, the teeth being attached laterally while they are free internally, or in the furrow destined for their reception. In the greater number the crown increases from above downwards. These teeth are so closely set that they seem to touch each other, and altogether form a very trenchant dentilated blade, though not long enough for cutting up substances of any thickness, nor does the bite of the animal inflict a wound.

The œsophagus is very wide, and M. Duméril notices an extraordinary appearance therein, when it is remembered that the part is not exposed to the light. In many species, both living and dead, which he examined, he found the interior of this canal strongly coloured with different but uniform shades, sometimes of an orange-yellow, but principally of a deep black. There is no distinct limit between the œsophagus and the stomach; the crop (jabot) is continuous, and the whole forms a kind of longitudinal sac, which appears to be suddenly narrowed at the point corresponding to the pylorus, which is not to be detected except by this diminution of diameter and its position on the free and lower edge of the liver. The intestine is arranged in folds, and about three times the length of the œs and ventriculus taken together, it turns to the left, and is lost on the side of a true and large cœcum, furnished with an appendage, and terminating by a large tube which has its opening in the cloaca.

The triangular liver is placed in the mesial line, but its upper angle is so much elongated, that in some species it forms a conical point, at least twice as long as the base. This point lies in front of the stomach in the space left by the two lungs when they are filled with air. Below, the liver enlarges, and is divided into many lobes or indistinct strips, with the exception of that on the left, which is longest. The gall-bladder is situated under the mesial lobe. M. Duméril states that there does not appear to be a pancreas, but he observed in the *Common Gecko* and in the *Fimbriated Gecko* (*Ptyodactylus fimbriatus*) a very small spleen situated on the left side of the stomach.

Circulating System.—The shape of the heart varies. In the Common Gecko it is large and flat, but has nevertheless a tolerably regular conical form, the point of the cone being below, and the base, which is slightly notched, leaning on the root of the two lungs. In the *Fimbriated Gecko*, on the contrary, M. Duméril states the heart to be proportionally smaller, and apparently formed of three distinct but approximated portions, the two upper rounded and oval, resembling auricles, and the other and lower portions small and conical. He acknowledges that he has not followed out the vascular system, but presumes that it resembles in its distribution that of the other Saurians.

Respiratory System and Organ of Voice.—The glottis consists of a longitudinal slit with two large lips, which form a sort of tubercle behind the posterior notched portion of the tongue, the movements of which it follows, and can consequently be lifted up and applied to the concavity of the palate. The trachea is very large, and the rings, which are cartilaginous anteriorly but membranous on the side next to the œsophagus, cause it to be considerably flattened. The lungs form two sacs, as in the Salamanders, and are nearly equal in volume and length. Their internal cavity is simple, but there are polygonal cellules on their internal membranous linings, and in the lines forming these the arterial and venous vessels are ramified. The Geckotidæ are without any goître, and M. Duméril is unable to account for the production of the voice, but he inquires whether the cry which they emit, and which is supposed to be in some degree imitated by their names of 'Gecko,' 'Geitje,' &c., may not be assisted by the movements of the tongue, and its reception in the concavity of the palate; analogous, we suppose, to the production of the sound with which a coachman or groom stimulates his horses by applying the tongue to the upper part of the mouth and suddenly withdrawing it.

Urinary and Genital Organs.—There is no urinary bladder, nor do the rounded kidneys, whose ureters are not long and open directly into the cloaca, require particular notice. The organs of generation in the males (which are smaller, more agile, and more brightly coloured than the females) are double, and lodged on each side of the base of the tail, which has consequently a swollen appearance. The eggs, which are often deposited between stones, are quite round, with a rather solid, slightly rough, calcareous shell, of a uniform dirty white. M. Duméril has seen these eggs produce the young ones, which were well formed and very nimble.

Peculiar Secretions.—The author last named states that he has observed in many species, some peculiar organs, sometimes double, sometimes united in a single flattened elongated mass under the abdominal parietes in front of the pubis, in place of a urinary bladder. They appeared to be of a fatty nature, and were sustained in one part by the os pubis, and on the other possessed vascular or membranous single or double prolongations, rising in the thickness of the peritoneum as far as the liver. Though he knows not the office of these organs, he thinks it probable that they may be destined to afford nourishment to the animal in a state of hybernation. The pores of the thighs, &c. secrete a thick humor; and M. Duméril observes that these pores afford no generic character.

Habits, Food, &c.—The Geckotidæ are none of them large in size, and the greatest number feed on small animals, such as insects, their larvæ and pupæ. These they catch either by lying in ambush or by pursuing their feeble prey in the holes and dark crevices to which it retires. The structure of their feet enables them to run in every direction over the smoothest surfaces, and they can even remain suspended beneath the large leaves which a luxuriant tropical vegetation so frequently puts forth. The sharp and retractile nails with which the feet of the greater number are armed enable them to cling to and make rapid progress on trees with the smoothest bark, to penetrate the holes of rocks, and to climb walls. Of sombre or varying colours adapted generally to the locality where their lot is cast, they will often remain for hours in positions as extraordinary as the flies and insects for which they watch, the wonderful apparatus with which their feet is furnished enabling them to overcome the general law of gravity, and without which they would instantly fall to the earth. The hues of their skins thus render them less objects of suspicion to the little animals for which they lie in wait, and also serve to dodge even the acute eye of the bird of prey that seeks to destroy them. Their eyes, as we have seen, enable them to discern objects in the dark, and are at the same time capable of bearing the rays of a bright sun; for many insects are nocturnal or crepuscular, while the great mass of them are diurnal. The pursuit of their prey leads them near the habitations of man, whose dwelling always attracts certain kinds of insects, and they sometimes fall victims to their appearance, which frequently inspires terror, and often disgust. A Gecko, confident in his powers of flight, appears boldly to await his adversary, and his sudden disappearance at a nearer approach adds to the horror which ..... uncouth form inspires. The poor Geckos too have a bad name. They are supposed to poison whatsoever they touch, be it animate or inanimate, and their saliva is said to vex the skin of those on whom it falls with foul eruptions. Many of these cuticular irritations, when they have actually existed from the intervention of these animals, may have arisen from the extremely sharp claws of a Gecko running over a sleeping man, or small blisters may have been raised by the adherent apparatus at the bottom of its feet.

Geographical Distribution.—The form is found in all the four quarters of the globe, and is widely distributed in warm climates. In this distribution Europe, as far as observation has yet gone, claims by far the fewest number. Two species only have yet been found in this quarter of the globe, and even these are common to the northern coasts of Africa. The Prince of Musignano has noticed them in the 'Fauna Italica,' under the names of *Ascalabotes Mauritanicus* and *Hemidactylus triedrus*. The former is a Platydactylus of Duméril and others. In Asia the greatest number are found: thirteen species are recorded as Asiatic. Africa is said to possess twelve, and America eleven species, as far as researches have hitherto gone. In Australasia and Polynesia there are said to have been found twelve species. M. Duméril, in his Table, gives the following numbers:—In Europe, 2; in Asia, 13; common to both, none. In Africa, 12; in America, 12; common to both, none. In Australasia and Polynesia, 12. Of unknown origin, 4: = 55. In addition to the 13 Asiatic species, there is another which is also found in South Africa and in the neighbouring islands. Some of the African species are found also in Madagascar, the Mauritius, and the islands of Seychelles, Teneriffe and Madeira. It is not clear that Mr. Gray's genus *Gehyra*, which he characterizes from a Gecko ...d in an island of the Pacific Ocean, is included in this ...ation. Besides the species which Mr. Gray describes ...'Zool. Proc.' (1834), he alludes to the probability ...two other species, one in the British Museum, and another in the Museum d'Histoire Naturelle, at Paris.

Systematic Arrangement, &c.

There can be little doubt that the Ἀσκαλαβώτης of Aristotle and of the Greeks generally was a Gecko. Aristophanes and Theophrastus, as Gesner has shown, speak of those lizards which the Italians called *Tarentola*, whose bodies were short and thick, and which clambered about the walls

in the interior of their edifices for the purpose of catching spiders, on which they fed, under the names of *Ascalabotes* and *Galeotes*. That the *Stellio* of Pliny was no other than a Gecko, Schneider has shown.

Linnæus placed the *Geckos* under his great genus *Lacerta*, and recorded but three species (1766).

Laurenti (1768) seems to have been the first modern who established the *Geckos* as a genus. Gmelin (1789—13th edit. of *Syst. Nat.*) introduced a section in the genus *Lacerta*, consisting of five species, under the name of *Gekkones*, and the term Gecko was used as a generic appellation for these Saurians by Lacépède (1790), Schneider (1797), Cuvier (1798), and Brongniart (1801).

Daudin (1803) divided the genus *Gecko* into three sections, taking for the basis of his division the number and connexion of the toes, the form of the tail, and the disposition of the scales. These sections consisted of the *Geckos* properly so called, the *Geckottes*, and the *Geckos* with a flat tail. M. Duméril, who has written so much and so well on this subject, and to whose writings we are so much indebted, states that in 1806 he profited by the foregoing works, and established in the *Zoologie Analytique* and in his public lectures the genus *Uroplatus* (1806), and he says that Oppel, in his *Prodromus* (1811), established the family *Geckotidæ* after his (Duméril's) indications. M. Duméril, who established also the genus *Urotornus*, adopts in great measure the system of Cuvier, and separates the *Geckotidæ* into two great divisions, each embracing subdivisions. These divisions take the structure of the toes for their basis; the first consisting of those *Geckotidæ* which have dilated toes; the second of those whose toes are not dilated. The subdivisions depend upon the variation in the structure of the lower part of the toes. The genera are—*Ascalabotes*, *Platydactylus*, *Hemidactylus*, *Ptyodactylus*, *Thecadactylus*, *Stenodactylus*, and *Gymnodactylus* (1836).

Cuvier (1817—1829) placed these Saurians under his great genus *Gecko*, which he divided into the following subgenera:—*Platydactylus*, *Hemidactylus*, *Thecadactylus*, *Ptyodactylus*, *Sphæriodactylus*; at the same time arranging those Geckos which have retractile claws, but slender or rather not enlarged toes, in three groups, under the names of *Stenodactylus*, *Gymnodactylus*, and *Phyllura*, the latter embracing those with a horizontally-flattened, foliated tail.

Merrem (1820) places the Geckos in the 1st tribe (*Gradientia*) of the class *Pholidoti*. The sub-tribe *Ascalabotes*, according to him, embraces the *Iguanidæ*, as well as *Geckos*.

M. Latreille (1801-1825) seems to have adopted the views and descriptions of Lacépède in the first instance, and not to have gone much beyond a change of nomenclature in the last work published by him.

M. Fitzinger (1826) makes his *Ascalabotöids* consist of the genera *Sarrubus*, *Uroplatus*, *Ptyodactylus*, *Hemidactylus*, *Thecadactylus*, *Ptychozöon*, *Platydactylus*, *Ascalabotes*, *Stenodactylus*, and *Phyllurus*.

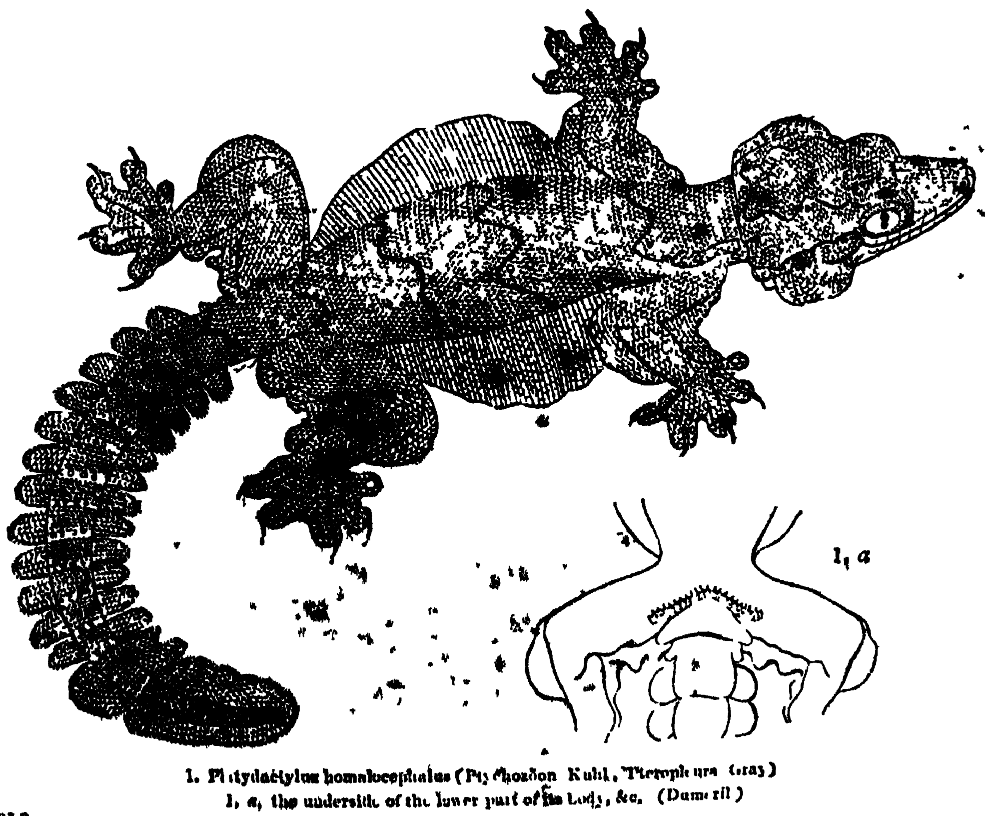
Mr. Gray (1827-1834) arranges the following genera under the family *Geckotidæ*:—*Hemidactylus*, *Platydactylus*, *Gecko*, *Pteropleura*, *Thecadactylus*, *Ptyodactylus*, *Phyllurus*, *Eublepharis*, *Cyrtodactylus*, *Phyllodactylus*, *Diplodactylus* (vol. ix., p. 11), and *Gehyra*.

Wagler (1830), under the family name of *Platyglossi*, makes the *Geckotidæ* consist of the following genera:—*Ptychozöon* (Kuhl), *Crossurus* (Wagler—*Uroplatus* of Duméril in part), *Rhacöessa* (Wagler—one of Duméril's *Uroplati*), *Thecadactylus* (Cuvier), *Platydactylus* (Cuvier), *Anoplopus* (Wagler), *Hemidactylus* (Cuvier), *Ptyodactylus* (Cuvier), *Sphæriodactylus* (Cuvier), *Ascalabotes* (Lichtenstein), *Eublepharis* (Gray), *Gonyodactylus* (Kuhl), and *Gymnodactylus* (Spix).

Dr. Cocteau (1835) arranges the Geckos in six divisions. 1, *Platydactylus*, containing five subdivisions, represented in part by *Anoplopus* of Wagler, *Phelsuma* (Cocteau), *Pachydactylus* (Wiegmann), *Ptychozöon* (Kuhl), and *Pteropleura* (Gray); with others resting principally upon the absence or presence of pores before the cloaca, and the development of the claws; 2, those Geckos which correspond to *Thecadactylus* of Cuvier; 3, *Hemidactylus*; 4, comprehending *Ptyodactylus* (*Uroplatus*, Duméril, *Rhacöessa*, Wagler, *Crossurus*, Wagler); 5, *Sphæriodactylus*, comprehending *Diplodactylus*, Gray, and *Phyllodactylus*, Gray; 6, *Stenodactylus*, (*Eublepharis*, *Gonyodactylus*, *Gymnodactylus*, *Cyrtodactylus*, *Pristurus*, *Phyllurus*).

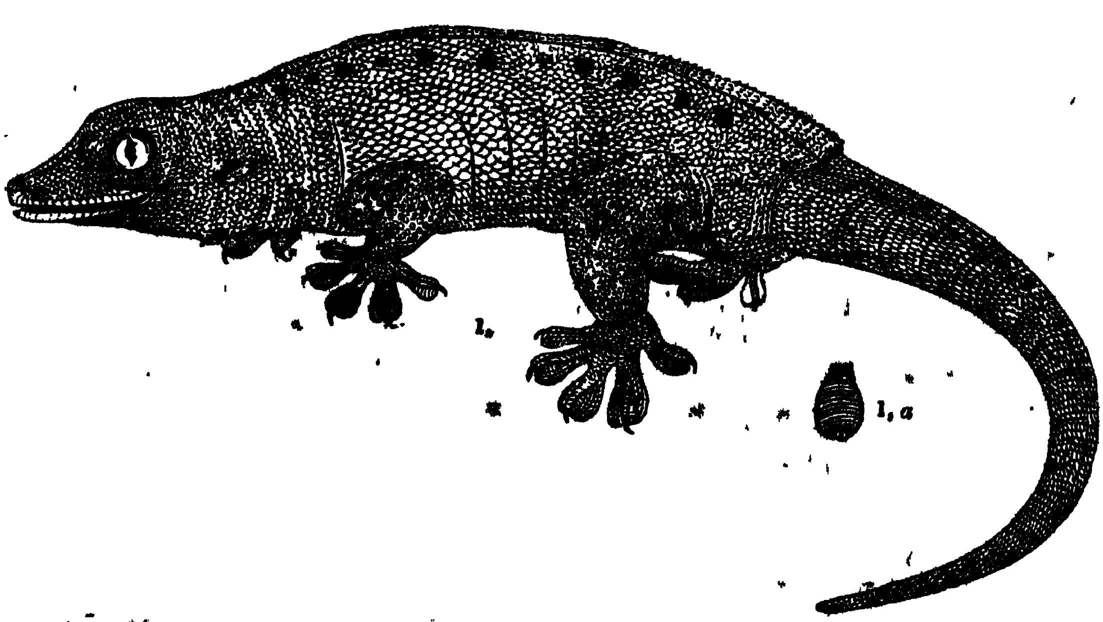
M. de Blainville ('Nouvelles Annales du Muséum,' April, 1836) places the family of *Geckos* at the head of the family of *Saurophians*. The species forming the genus *Platydactylus* of Cuvier he designates as *Geckos*; those ranging under *Hemidactylus* as *Demi-Geckos*; the *Ptyodactyli* as *Tiers-Geckos*; the *Stenodactyli* as *Quart-Geckos*; and the *Gymnodactyli* as *Sub-Geckos*.

The following cuts will convey an idea of the form of some of the Geckotidæ:—



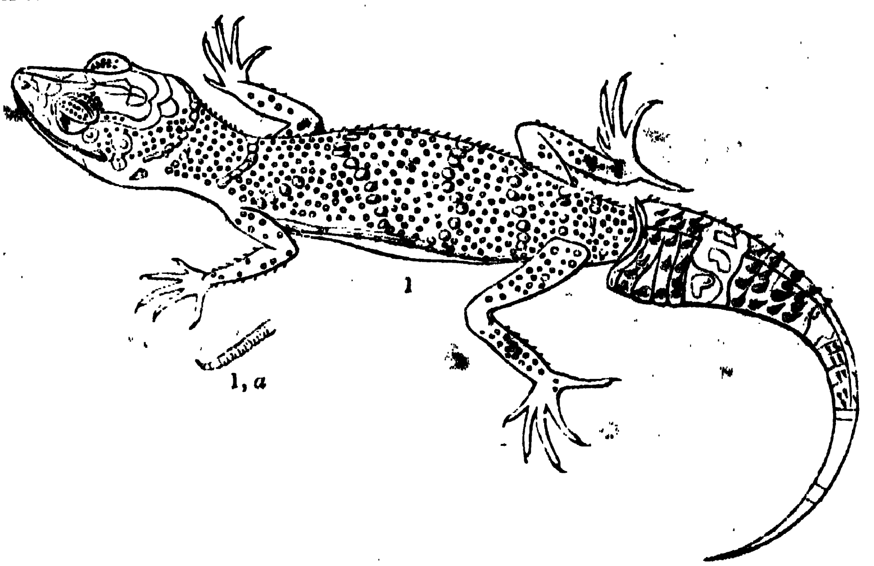
1. Platydactylus homalocephalus (Ptychozöon Kuhl, Pteropleura Gray)
1, a, the underside of the lower part of its body, &c. (Duméril)

Locality, Java.
P. C., No. 671.



1. Platydactylus Seychellensis. (Duméril.)
1, a, the underside of one of its toes.

Locality, the Seychelles Islands.



1. Gymnodactylus Milliusii (Cyrtodactylus Milliusii, Gray).
1, a, the underside of one of its toes. (Duméril.)

Locality, New Holland.

The student who wishes to follow out the natural history of this family of Saurians should consult the works of Aldrovandi, Aristotle, Bonaparte (Prince of Musignano), Brongniart, Creveldt, Cuvier, Duméril, Edwards, Eichvald, Feuillée, Flacourt, Geoffroy, Gesner, Gmelin, Gray, Hermann, Houttuyn, Knorr, Kuhl, Lacépède, Latreille, Lesson, Lichtenstein, Linnæus, the Prince of Neuwied, Oppel, Osbeck, Pallas, Perrault, Pisa, Pliny, Rafinesque, Risso, Rüppel, Ruysch, Schneider, Schinz, Seba, Sparmann, Spix, Tilesius, Wagler, White, Wiegmann, and Wormius.

GEDDES, ALEXANDER, LL.D., was born at Arradowl, in the parish of Ruthven and county of Banff, in Scotland, in A.D. 1737. His parents, who were in humble circumstances, were enabled, by the kindness of the laird of the village, to give their son a respectable education. After spending seven years at Scalan, a Roman Catholic seminary in the Highlands, he was removed at the age of twenty-one to the Scotch college in Paris, where he diligently studied theology, and made himself master of most of the modern European languages. On his return to Scotland he resided for some time in the house of the Earl of Traquaire; and, after paying another visit to Paris, he accepted, in 1769, the charge of a Catholic congregation at Auchinhalrig in the county of Banff, where he remained for ten years, beloved by his people, and attentive to the duties of his station. He had resolved—in the early years of his life to make a new translation of the Bible into the English language, for the use of the Roman Catholics; but pecuniary difficulties prevented him during his residence at Auchinhalrig from obtaining the necessary books. On his removal to London, in 1779, he was introduced to Lord Petre, who warmly approved of his purpose, and engaged to allow him 200*l.* a year for his life, and to procure for him all the works that he considered requisite. Thus encouraged he published, in 1780, a pamphlet under the title of an 'Idea of a new version of the Holy Bible, for the use of the English Catholics,' in which he proposed to make the Vulgate the basis of his new translation. This plan being afterwards abandoned, he resolved to make an entirely new translation from the Hebrew and Greek; for if he had adopted the former method, he stated 'that he must have been perpetually confronting the Vulgate with the originals, and very often correcting it by them; or presented his readers with a very unfair and imperfect representation of the sacred text.' In accomplishing this work, his first object was directed to obtaining an accurate text, and no labour was spared by this indefatigable scholar to render the translation as complete as possible. He consulted the most eminent biblical scholars of the day, among whom were Dr. Kennicott, and Dr. Lowth, the bishop of London, who assisted him with their advice. The prospectus, which contained an account of his plan, was published in 1786; this was soon followed by a letter to the

bishop of London, containing 'Queries, doubts, and difficulties, relative to a vernacular version of the Holy Scriptures,' by a specimen of the work, and by a 'General Answer to the queries, counsels, and criticisms' which his prospectus and specimens had called forth. It was not however till 1792 that the first volume of the translation was published under the title of 'The Holy Bible, or the Books accounted sacred by the Jews and Christians, otherwise called the Books of the Old and New Covenants, faithfully translated from corrected texts of the originals, with various readings, explanatory notes, and critical remarks;' the second, which contained the translation to the end of the historical books, appeared in 1793; and the third, which contained his critical remarks upon the Pentateuch, in 1800. The remainder of the work was never finished; he was employed at the time of his death on a translation of the Psalms, which he had finished as far as the 118th Psalm, and which was published in 1807. He died at London on the 26th of February, 1802, in the 65th year of his age.

In his translation and commentary Dr. Geddes maintained opinions very similar to those held by that class of divines in Germany denominated *Rationalist*, and of whom Eichhorn and Paulus were the most celebrated in his day. He considered the writers of the Scriptures to have had the same degree of inspiration which has been granted to good men in all ages, and which, according to the common meaning attached to the word inspiration, amounts to none at all. He disbelieved the divine mission of Moses, and asserted that 'Moses only did what all other antient legislators had done, required a greater or less degree of implicit obedience to their respective laws, and for that purpose feigned an intercourse with the Deity to make that obedience more palatable to the credulous multitude.' He rejected the various miracles ascribed to him, or laboured to reduce them to the standard of natural phenomena. He explains the account of the creation in the book of Genesis 'as a most beautiful mythos or philosophical fiction, contrived with great wisdom, and dressed up in the garb of real history.' These and similar opinions exposed the author to severe censure; and charges of infidelity and of a desire to undermine the authority of the Scriptures were widely circulated against him. His own church was the first to condemn him; a pastoral letter, signed by three out of four of the apostolical vicars of England, forbad the faithful from reading his translation; and Dr. Geddes himself was soon afterwards deposed by the apostolical vicar of the London district from the exercise of his duties as a priest. We cannot be surprised at this, for though he professed himself a member of the Catholic Church, he disclaimed all papal authority, and was strongly opposed to many of the tenets of that church. His heterodox opinions on these subjects had occasioned a similar suspension from his office when he officiated as priest at Auchinhalrig. To vindicate his character Dr. Geddes published an 'Address to the public on the publication of the first volume of his new translation of the Bible,' in which he repelled the charge of infidelity, and asserted, 'I willingly confess myself a sincere though unworthy disciple of Christ; Christian is my name, and Catholic my surname—rather than renounce these titles I would shed my blood.' We have no reason for doubting the truth of this declaration; his whole life showed that he was a diligent inquirer after truth. Though we may consider the opinions of Dr. Geddes as detrimental to the authority of the Scriptures, we have no reason on that account for charging him with infidelity, since he believed that his interpretation of the Scriptures tended to place Christianity on a firmer basis, and that 'those were the enemies of religion who seek to support her on rotten props, which moulder away at the first touch of reason, and leave the fabric in the dust.' His translation is well described by Dr. Mason Good (*Life of Geddes*, p. 358) to be, 'for the most part, plain and perspicuous, conveying the sense of the original in its native simplicity. But his language is occasionally unequal, and strongly partakes of the alternations of his own physical constitution; in consequence of which, in the midst of a passage most exquisitely rendered in the main, we are at times surprised with scholastic and extraneous expressions, or disgusted with intolerable vulgarisms.' It cannot be denied that his work was a valuable help to the science of biblical criticism in this country, and it must have been a source of consolation to him, in the midst of the virulence with which he was assailed in England, to know that such men as Paulus and Eichhorn appreciated his labours; the latter of whom observed that Dr. Geddes was the only individual by whose opinion he would consent to be judged.

In addition to his translation, Dr. Geddes published many other works, most of which had only a temporary interest, as they were written on the politics of the day, or on some theological or literary dispute which has long since been settled. A complete catalogue of them is given in the beginning of Dr. Mason Good's 'Memoirs of the Life and Writings of the Rev. Alexander Geddes, LL.D.,' published in 1803. (See Graves *on the Pentateuch*, and the 4th, 14th, 19th, and 20th volumes of the *British Critic*, old series, for a review of his theological opinions.)

GEDIKE, FRIEDRICH, was born at Boberow, near Lenzen in Brandenburg in the year 1754. The death of his father, when he was but nine years old, plunged him in great distress, and he was taken to the Orphan Asylum at Züllichau. Dr. Steinbart, who was director of the public institutions for instruction in this place, educated him seven years at the Asylum. In 1766 Steinbart founded a school of his own, where Gedike became a pupil, and here talents which had hitherto lain dormant began to manifest themselves. He went to the university at Frankfort in 1771, and studied under Töllner. On the death of Töllner, Steinbart, who succeeded him, once more became his instructor. In 1775 Spalding appointed Gedike private teacher to his two sons, and in 1776 he was made subrector of the Friedrichwerder Gymnasium at Berlin, of which in a few years he became director. He now showed himself to be one of the most eminent teachers in Germany. Indefatigable in devising new methods of instruction, and constantly aiming at improvements, he animated both pupils and tutors, and raised the almost sinking establishment to a high eminence. He became in 1795 director of the Berlin Gymnasium, having previously received the degree of doctor of theology. He died in 1803.

The works of Gedike are chiefly school-books and works on education, but he also published an edition of the 'Philoctetes' of Sophocles, and of select dialogues from Plato, as well as some translations of Pindar, which are mentioned with respect.

GEERTRUYDENBERG. [BRABANT.]

GEESE. [GOOSE.]

GEHLENITE, a mineral which occurs in imbedded and massive aggregations of rectangular or slightly rhombic crystals. Primary form uncertain. Cleavage parallel to the planes of a rectangular or rhombic prism. Surface usually rough and dark. Fracture uneven, passing into splintery. Hardness, 5·5 to 6. Colour in general grey, frequently with a yellowish or greenish tint. Lustre slightly vitreous, resinous. Translucent slightly or opaque. Specific gravity, 2·832 to 3·029.

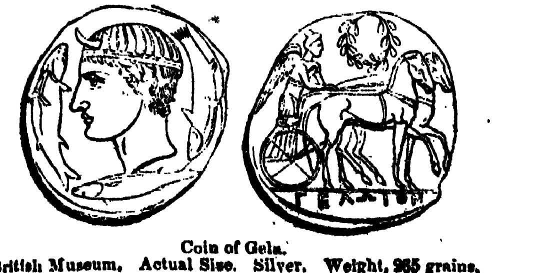
Before the blowpipe gehlenite suffers no change when alone. With borax it melts with difficulty into a glass coloured by oxide of iron. When heated in hydrochloric acid it gelatinizes.

This mineral occurs only in the valley of Fassa in the Tyrol. By analysis it yielded, according to

	Fuchs.	Dr. Thomson.
Silica	29·64	29·132
Alumina	24·80	25·048
Lime	35·30	37·380
Protoxide of iron	6·56	4·350
Water	3·30	4·540
	99·60	100·450

GEHYRA. [GECKO, vol. xi., pp. 104, 105.]

GELA, a Grecian colony on the south-western coast of Sicily, was founded by a joint colony from Crete and from Lindus, a city in Rhodes, forty-five years after the foundation of Syracuse. (Herod., vii. 153; Thuc., vi. 4.) It was



Coin of Gela.
British Museum. Actual Size. Silver. Weight, 265 grains.

one of the most powerful of the Grecian colonies in Sicily, and continued so to the time of Gelon [Gelon], who removed the greater part of its inhabitants to Syracuse: after which it rapidly sunk in importance, and never again obtained its former power. The modern town of *Terra Nova* is supposed to have been built upon its site. The Minotaur on the coin of Gela, below, is symbolical of the origin of the city.

Coin of Gela.
British Museum. Actual size. Silver. Weight, 269½ grains.

GELA'SIMUS, a genus of Brachyurous Crustaceans. [Ocypodians.]

GELA'SIUS I. succeeded Felix II. as bishop of Rome, A.D. 492, and carried on the controversy with the Greek church which had begun under his predecessor, but without bringing it to any conclusion. He died in 496, and was succeeded by Anastasius II. Gelasius wrote several theological works, such as 'De Duabus Naturis in Christo,' in which he expresses sentiments which are considered as opposed to transubstantiation. It is found in the Lyon *Bibliotheca Maxima Patrum*.

GELA'SIUS II., a Benedictine monk, succeeded Paschal II., A.D. 1118. The popes were then at open war with the emperors of Germany; and the partizans of the latter at Rome, headed by the powerful family of Frangipani, opposed the election of Gelasius, and afterwards seized him and personally ill-treated him, until he was rescued from their hands by the præfect of Rome. Soon after, the Emperor Henry V. came himself with troops, and the pope having run away to Gaëta, an anti-pope was elected by the Imperial party, who styled himself Gregory VIII. Gelasius, after many wanderings, repaired to France, where he held a council at Rheims. He died at the convent of Cluny, in January, 1119, after a short but stormy pontificate, and was succeeded by Calixtus II.

GELATIN. [Food, vol. x., p. 343.]

GELDER ROSE, or rather, GUELDRES ROSE, a double variety of the Viburnum Opulus, a marsh shrub, common in this country and all the north of Europe. The name of this variety is supposed to indicate its origin in the Low Countries: it is also called the snowball-tree, in allusion to its large white balls of flowers.

GELE'E, CLAUDE. [Claude Lorraine.]

GELLERT, CHRISTIAN FURCHTEGOTT, born near Chemnitz, in Saxony, acquired a great reputation as a writer of fables and as a moralist. The simplicity of his manners, his candour, and goodness of heart, contributed to render him popular with all classes. Frederic II. and Prince Henry were very partial to him, notwithstanding his habitual shyness. His 'Fabeln und Erzählungen' had a prodigious success in Germany. He also wrote 'Sacred Odes and Songs,' which are much esteemed. His 'Letters' have also been published. The collection of his works, 'Sämmtliche Werke,' forms part of the 'Karlsruher Deutscher Classiker,' 1823-6. His fables and letters were translated into French, 5 vols. 8vo., with a biographical notice of the author. Gellert died at Leipzig, where he was professor of philosophy, in December, 1769, and a monument was raised to him in the church of St. John, with a cast of his head in bronze. The bookseller Wendler, who published his works, also raised a monument to the memory of Gellert in his garden.

GE'LLIUS, AULUS (or, according to some writers, Agellius), the author of the 'Noctes Atticæ,' was born at Rome in the early part of the second century, and died at the beginning of the reign of the Emperor Marcus Aurelius. We have few particulars of his life; we know that he studied rhetoric under Cornelius Fronto at Rome, and under Phavorinus at Athens, and that he was appointed at an early age to a judicial office. (*Noct. Att.* xiv. 2.) The 'Noctes Atticæ' was written, as he informs us in the preface to the work, during the winter evenings in Attica, to amuse his children in their hours of relaxation. It appears from his own account, that he had been accustomed to keep a common-place book, in which he entered whatever he heard in conversation or met with in his private reading that appeared worthy of memory. In composing his 'Noctes Atticæ,' he seems merely to have copied the contents of his common-place book with a little alteration in the language, but without any attempt at classification or arrangement. This work contains anecdotes and arguments, scraps of history and pieces of poetry, and dissertations on various points in philosophy, geometry, and grammar. Amidst much that is trifling and puerile, we obtain information on many subjects relating to antiquity, of which we must otherwise have been ignorant. It is divided into twenty books, which are still extant, with the exception of the eighth and the beginning of the seventh. He mentions, in the conclusion of his preface, his intention of continuing the work, which he probably never carried into effect. The 'Noctes Atticæ' was printed for the first time at Rome, 1469, and has been frequently reprinted; the most valuable editions are the Bipont., 2 vols. 8vo. 1784, the one published by Gronovius, 4to. 1706, and a recent one by Lion, 2 vols. 8vo., Göttingen, 1824. The work has been translated into English by Beloe, 3 vols. 8vo., London, 1795; and into French, by Douzé de Verteuil, 3 vols. 12mo., Paris, 1776—1777.

GELON, a native of Gela, rose from the station of a private citizen to be supreme ruler of Gela and Syracuse. He was descended from an ancient family, which originally came from Telus, an island off the coast of Caria, and settled at Gela when it was first colonized by the Rhodians; at which place his ancestors held the office of hereditary minister of the infernal gods (χθόνιοι θεοί (Herodotus, vii. 153). During the time that Hippocrates reigned at Gela (B.C. 498—491), Gelon was appointed commander of the cavalry, and greatly distinguished himself in the various wars that Hippocrates carried on against the Grecian cities in Sicily. On the death of Hippocrates, who fell in a battle against the Siceli, Gelon seized the supreme power (B.C. 491). Soon afterwards a more splendid prize fell in his way. The nobles and landholders (γαμόροι) of Syracuse, who had been expelled from the city by an insurrection of their slaves supported by the rest of the people, applied to Gelon for assistance. This crafty prince gladly availing himself of the opportunity of extending his dominions, marched to Syracuse, into which he was admitted by the popular party (B.C. 485), who had not the means of resisting so formidable an opponent. (Herodotus, vii. 154, 155.) Having thus become master of Syracuse, he appointed his brother Hieron governor of Gela, and exerted all his endeavours to promote the prosperity of his new acquisition. In order to increase the population of Syracuse, he destroyed Camarina, and removed all its inhabitants, together with a great number of the citizens of Gela, to his favourite city. As he was indebted for his power in Syracuse to the aristocratical party, he took care to strengthen it against the people. Thus when he conquered the Megarians and Eubœans of Sicily, he transplanted to Syracuse all those who were possessed of wealth, but sold the remainder as slaves. (Herod. vii. 156.) By his various conquests and his great abilities he had become a very powerful monarch; and therefore, when the Greeks expected the invasion of Xerxes, ambassadors were sent to Syracuse to secure if possible his assistance in the war. Gelon promised to send to their aid 200 triremes, 20,000 heavy-armed troops, 2000 cavalry, and 6000 light-armed troops, provided the supreme command were given to him. This offer being indignantly rejected by the Lacedæmonian and Athenian ambassadors, Gelon sent, according to Herodotus, an individual named Cadmus to Delphi with great treasures, with orders to present them to Xerxes if he proved victorious in the coming war. (Herod. vii. 157—164.) This statement however was denied by the Syracusans, who said that Gelon would have assisted the Greeks, if he had not been prevented by an invasion of the Carthaginians with a force amounting to 300,000 men under the command of Hamilcar. This great army was entirely defeated near Himera by Gelon, and Theron, monarch of Agrigentum, on the same day on which the battle of Salamis was fought. (Herod. vii. 165—167.) An account of this expedition is also given by Diodorus (b. xi. p. 254, Steph.), who states that the battle between Gelon and the Carthaginians was fought on the same day as that of Thermopylæ.

Gelon appears to have used with moderation the power which he had acquired by violence, and to have endeared himself to the Syracusans by the equity of his government and the encouragement he gave to commerce and the fine arts,

There are still existing many coins of Gelon and his successor Hieron, of beautiful workmanship, of which a description is given in Mionnet, vol. i. p. 328. It is supposed by some that these coins were not struck in the time of Gelon, but by order of Hieron II. (B.C. 275—216), a supposition somewhat inconsistent with the number of coins still remaining. We are informed by Plutarch, that posterity remembered with gratitude the virtues and abilities of Gelon, and that the Syracusans would not allow his statue to be destroyed, together with those of the other tyrants, when Timoleon was master of the city. ('Life of Timoleon,' p. 247.) He died B.C. 478, and was succeeded by his brother Hieron. (Aristotle, *Polit.* b. v., c. 12, p. 678, Elzevir.)

Coin of Gelon.
British Museum. Actual size. Silver. Weight, 98 grains.

GEMELLA'RIA. [CELLARIÆA, vol. vi., p. 405.]

GEMICELLA'RIA. [CELLARIÆA, vol. vi., p. 404.]

GE'MINI (the Twins), the third constellation in the Zodiac. The Greeks refer it not only to the fable of Castor and Pollux, but also to those of Hercules and Apollo, Triptolemus and Iasion, Amphion and Zethus, &c.

The principal stars are as follows:—

Character.	No. in Catalogue of Flamsteed, (Piazzi,) [Bradley.]	No. in Catalogue of Astron. Society.	Magnitude.	Character.	No. in Catalogue of Flamsteed, (Piazzi,) [Bradley.]	No. in Catalogue of Astron. Society.	Magnitude.
(H)	1	749	5	(z)	53	891	6½
	2	754	7	λ	54	898	5
	3	760	6½	δ	55	900	3
	4	762	7	(q)	56	906	6½
	5	766	7	A	57	907	5½
	6	769	7		58	908	7½
η	7	775	4½		59	909	6
	8	779	7½	ι	60	911	4½
	9	782	7	ρ	62	918	5
	11	786	8	(p)	63	916	6
μ	13	790	3	b^1	64	919	6
	15	799	7	b^2	65	922	6
	16	801	7	α	66	927	1
ν	18	804	4		67	926	7½
	19	809	7	(k)	68	929	6
	21	811	6	υ	69	933	5
γ	24	820	2½	f	74	940	6
	25	825	7	σ	75	943	5
(u)	26	828	5	c	76	946	6
ε	27	831	3	κ	77	947	4½
	28	832	6	β	78	948	2
ξ^1	30	833	6		79	949	7
ξ^2	31	836	4½	g	81	951	6
(G)	33	842	6½	(B)	82	956	6
θ	34	846	4	φ	83	963	5
	35	843	6	(l)	85	967	6
d	36	844	6		(39)	893	7
	37	850	6		(78)	792	7
e^1	38	851	6		(87)	795	7
(y^1)	39	861	6½		(89)	796	7
(y^2)	40	864	6		(126)	808	7
	41	866	6		(144)	814	6½
ω^1	42	870	6		(144)	934	7
ζ	43	872	3½		(179)	945	7
ω^2	44	876	6½		(224)	960	7
(o)	45	879	6		(270)	855	7
τ	46	881	5		(281)	859	7
	47	882	6		(294)	865	7
(m)	48	885	6		(305)	871	6½
	51	888	5½		[1090]	931	7
(n)	52	889	6½		[1101]	939	7

This constellation derives its name from two remarkable stars, of the first and second magnitude, to which the names of Castor (or α Geminorum) and Pollux (or β Geminorum) are given. The latter star is marked by Flamsteed as of the first magnitude, by the greater part of astronomers as of the second, and by Piazzi as of the third! These two stars, whose proximity will cause them to be easily recognised when once known, may be found by drawing a line through the belt of Orion and the two bright stars the line of which cuts through the belt. This line, lengthened upwards, will pass very near to the two stars of Gemini. They are also about halfway between Regulus and Aldebaran: and if the Great Bear and Orion be seen together, then Capella on the one side, and Castor and Pollux on the other, will be conspicuous boundaries of the intermediate space.

GEMINIA'NI, FRANCESCO, a very distinguished composer, and also a famous violinist, was born at Lucca, about the year 1680. The foundation of his profesional knowledge was laid by Alessandro Scarlatti, but he completed his studies under Corelli. England was then, as now, the place of attraction for foreign musical talent, and Geminiani arrived in London in 1714, where his performance speedily gave him celebrity. He soon became acquainted with Baron Kilmansegge, chamberlain to George I. as Elector of Hanover, through whose means he was introduced to the king, and had the honour to perform before that sovereign some of his recently published Sonatas, for '*Violino, Violone, e Cembalo*,' in which Handel accompanied him on the harpsichord. Successful as he was professionally, his finances were continually in a disordered state, for some demon whispered 'Have a taste,' and following such seductive advice, he indulged in the passion for collecting pictures, which he often sold again at a loss, and thus not only expended all that his talent and labour acquired, but too frequently was tempted to neglect his business. Embarrassed circumstances were the unavoidable result; he therefore applied for the appointment of Composer of State Music in Ireland, and through the interest of the Earl of Essex was nominated to that good situation; but belonging to the Catholic communion, and, though no bigot, refusing to take oaths irreconcilable to his conscience, the office was given to his pupil, Matthew Dubourg. He now set down industriously to compose, and published numerous works. Six of Corelli's Solos and as many of that great musician's Sonatas he converted into Concertos for a band, and in so efficient a manner, that some of them are yet annually listened to with delight at the Ancient Concerts. These were followed by his own Six Orchestral Concertos, *Opera Terza*, and Twelve Sonatas for Violin and Base, all of which abound in beautiful melody, and evince his skill in harmony. His deep knowledge of the latter was further exhibited soon after, in his *Guida Armonica*, which the old musicians treated as one of those attempts at innovation that ought to be resisted, and omitted no means in their power to prevent the sale of a work which they had not wit enough to understand. A French critic however, the Père Castel, wrote a vindication of it in the *Journal des Savans*, a publication of vast influence at that time, and Geminiani finally triumphed over his obstinate and jealous opponents. But as the emoluments arising from his many publications were by no means commensurate to the thought and time necessarily bestowed on them, or to his expensive habits, his necessities still pursued him, and he had recourse to a kind of benefit-concert at Drury Lane theatre, by which he made a considerable sum, and was thus enabled to gratify his love of travelling. He went to Paris, and there printed two sets of Concertos. On his return to England he continued composing and publishing. In 1761 he paid a visit to his friend Dubourg, in Dublin; but soon after his arrival in that city he lost, through the treachery of a servant, a manuscript treatise on music, on which he had bestowed much time and labour, and on the success of which his hopes of future independence were founded. This he never recovered; and the circumstance so preyed on his mind, that we are told it shortened his life, though probably not by any long period, for he reached his eighty-third year, and breathed his last in the Irish capital in 1762.

GEMMASTRÆA. [MADREPHYLLIÆA.]

GEMMULI'NA. [FORAMINIFERA, vol. x., p. 346.]

GEMS. [CAMEO; INTAGLIO.]

GENDARMERIE (from *Gens d'Armes*, men-at-arms) was a chosen corps of cavalry under the old monarchy of France: it is mentioned with praise in the wars of Louis XIII. and Louis XIV. Under the present system the gendarmerie is a body of soldiers entrusted with the police

all over France; it furnishes patrols, arrests criminals, examines the passports of travellers, and contributes to the maintenance of good order. Gendarmes are generally stationed at the barriers or gates of the towns, at the principal inns on the roads, at markets and fairs, and along the lines of the frontiers. They are divided into foot and horse: *gendarmes à pied, gendarmes à cheval*. They form a distinct corps in the army, under their own superior officers, who are under the orders of the ministers of the interior and of police; but in case of war, they may be called into active service like the other corps of the army. The gendarmerie is mostly recruited from old and deserving soldiers of other regiments, who consider it as a promotion, as they have better pay and enjoy greater liberty. This explains why the gendarmes, generally speaking, are remarkably well behaved and trusty men, who, while strictly executing their duties, behave with considerable civility towards unoffending people, such as travellers, and especially foreigners. The same description of troops exists in the Italian states, where they are called Carabineers.

GENDER is a grammatical principle entering into the structure of nearly every language, according to which nouns are distributed into classes. There are, strictly speaking, but two genders, *masculine* and *feminine*; those which belong to neither of those classes were said to be *neutrius generis*, of neither gender: this third class are called somewhat incorrectly *neuters*, and hence by a second irregularity it is the ordinary practice of grammarians to speak of three genders.

That sexual distinction was the fountain from whence the doctrine of grammatical gender was derived cannot be reasonably disputed. As a consequence of this the principle must have been confined originally to living beings, and among these it must have been still further limited to those animals where the distinction of the sex was readily perceived, as in the mane of the lion, the plumage of the peacock, or the magnitude of the bull. In the smaller animals it would be often difficult to ascertain the sex, and useless to denote it. But utility and truth are not the sole governing principles of language; they are often sacrificed to the love of imagery and personification. Thus the beautiful and pleasing absurdity which characterises the language of fable recommends itself to the infant mind whether of the savage or the child. The rose, the lily, the sun, the moon, are all endowed with the faculty of speech, and it then becomes almost necessary to add the distinction of sex. Here the choice must depend upon the association of ideas. Action, freedom, strength, magnitude, and violence, are the marked attributes of the male; sufferance, subjection, timidity, together with pregnancy, of the female. In the application of these notions, the realities of nature are often neglected. The domestic animals, having lost all the violence of the natural state, convey to the mind the idea of something feminine. Thus among the Romans even the dog was in ordinary language considered to be of that gender; while the English, contrasting that noble and powerful animal with the clean and delicate but irritable cat, have allotted the masculine gender to the dog, to the other the feminine. The feathered creation again, by their small size, their weakness, and the delicacy of their plumage, are naturally associated with the tender sex, with the exception commonly of the eagle, kite, hawk, &c.

In the meanwhile the neuter is employed to denote that the notion of gender is not entertained; it is therefore, as Grimm has well observed, the proper grammatical form for the young of animals where the sexual distinctions are imperfectly developed. Thus in the greater part of the Teutonic languages, the terms for *foal, calf, lamb, child*, &c., are of the neuter gender; and in the Greek there occur many similar forms, as *τεκνον, βρεφος*, &c. Hence by an easy connexion the diminutives generally in the Greek and Teutonic languages are of the same gender. In the further extension of the idea of gender, first to material objects without life, and then to abstract terms and mental notions, the directing associations are weaker, and the mind is in a state of oscillation. It may be observed however that abstract nouns, or to speak more correctly, general terms, are usually included among the feminines, perhaps from a notion of pregnancy, the one term including a large aggregate of concrete ideas. There are indeed exceptions to this principle; for instance, in the large family of Latin words which have the suffix *or* (*honor, pudor*, &c.), but this variety is probably to be explained by the similarity of the termination to the masculine suffix *tor*. The French language has corrected this anomaly in *la pudeur*, &c.

The mode of denoting gender is also deserving of consideration. One of the most direct methods would appear to be to assign names absolutely different to the male and female, that is, in those cases where the terms are used in their natural, not their metaphorical sense. Thus we have in our own language *boy* and *girl, horse* and *mare, bull* and *cow*, &c. One of the defects of such a principle would be the want of a general rule by which to denote the gender in any new instance, and the consequent multiplication of terms. But independently of the advantages and disadvantages of this notation, there are good reasons for believing that in fact the distinction of sex was not originally denoted by an absolute difference of term.

The word *man*, for instance, in the oldest Teutonic language had the general meaning of a human being, like the Greek *ανθρωπος*, or Latin *homo*, and only gained the exclusive notion of a male when its derivative *mannisco* or *mensche* was formed to express the general idea. The German term *frau* again is now confined to the female, but there is found in nearly all the older dialects of the German a masculine so nearly identical (*frauha*, Gothic; *frô*, old high German; *froho*, old Saxon; *frea*, Anglo-Saxon) that the notion of the female can scarcely have been inherent in the word. Similar results would be given by an examination of the English word *maid*, the Latin *puer*, &c. In the animal kingdom the same confusion prevails. The Latin *ovis* is commonly feminine; and in fact our English term *ewe* may be indisputably proved to be the same word; still, in the earlier form of the Latin language, the word was also applied in the sense of *aries*. It occurs, for instance, in the name of the sacrifice *Suovetaurilia*, where the word *taurus* leads us to expect the idea of a *ram* in *ovis*, and of a boar in *sus*; and in fact antient reliefs prove that the animals sacrificed at this festival were uncastrated males. The word *sus*, corresponding in ordinary signification, as also in form, to the English *sow*, is a parallel case. Indeed the Greek language exhibits this very word as not confined to either sex. A long enumeration of similar instances, with the necessary proofs, would be out of place here. It will be sufficient to notice that the English terms *mare* and *hen* appear in other branches of the Teutonic language as representatives of the male. Lastly, those who attribute to those monosyllabic forms a distinct notion of gender will find it difficult to avoid the inference that if *gallus*, for example, originally meant a *cock*, and not, as is here maintained, a *fowl* generally, *gallina* included the notion of both sexes, a *female cock*. A more simple mode of denoting gender is by the addition of a special suffix. Thus the Latin termination *on*, like the Italian *one*, appears to have carried with it the idea of magnitude, as in the familiar cognomina *Nuson, Capiton*, &c. It was therefore well adapted to denote the male gender, which is commonly accompanied by superior magnitude. Thus *leon*, a lion, is in reality formed of two words, *le* or *li*, the simple name of the animal, and *on*, great. The form *li* (nom. λις) occurs in the Greek language as well as λεων; and moreover, if the name of the animal was thus monosyllabic, it is seen at once how natural it was to adopt it, as was in fact the case, for the hieroglyphical symbol, or at any rate for the Hebrew character of the letter *l*. The addition of the feminine suffix *ina* or *aina* to the same root *le* gave the female *leaena*; and indeed the same suffix appears in *gallina, regina*, the Greek *βασιλιννα*, the German *königinn*, &c. Of the male suffix other examples may be seen in *centurion, capon, falcon, pavon*, &c.; the last of which may be compared with the Greek *ταως*, and the English *pea-cock*. The most frequent suffix in the Greek language to denote the feminine is the syllable *sa*, as in *Phoinissa, Kilissa*, and the participles *tuptont-sa*, the parent of *tuptousa, tuphthent-sa*, afterwards *tuphtheisa*. The same suffix is found in the Gothic, as *gait-sa, capra*; and in German, as *farre*, a bull, *färse*, a cow. Our own language too is familiar with what is probably the same suffix in *seamstr-ess, laundress* (from *lavender-ess*). In the Greek language this suffix appears at times to have lost its sibilant, as was so common in that language. Hence the forms *βασιλε-ια, οἰκ-ια, τετυφυ-ια*, for *τετυφοτ-ια*.

Thus, at last, the vowel *a* appeared to be the characteristic of the feminine gender; and it would appear to be the result of error rather than of principle, that in the Latin language the first declension got connected with that gender. The forms *scriba, incola*, &c., with the numerous

proper names, *Cinna*, *Sulla*, &c., prove that the notion of the female was not inherent in this declension; and probably the fact was that there co-existed in Italy two dialects, one preferring *a*, the other *o* (precisely as in our own island, there are the two forms *two* and *twa*, *who* and *wha*, *one* and *ane*); and secondly, that by a false refinement in language, an arbitrary distinction of gender was set up between them. The same argument of course applies to the Greek form *ἀγαθο-ς* and *ἀγαθα* or *ἀγαθη*, in which it must be carefully recollected that the sibilant at the end of *ἀγαθος* has nothing to do with the question, as it is simply the representative of the nominative case. It should also be recollected that the older Greek language abounds in the common adjectives, such as ὁ and ἡ *ἀθανατος*. Moreover the advocates of an original distinction of gender in the two first declensions have to explain the anomalies of such forms as ἡ *ὁδος*, &c., and the Latin *manus*, *fagus*, &c. Again, that the Latin forms *bono* and *bona* were originally but dialectic varieties appears to be established by the consideration that nearly all derivatives from the second declension take an *a*, as *albare*, *aurare*, &c., a strange consequence of which is, that the Latin language is almost wholly deprived of a conjugation of verbs in *o* corresponding to the Greek *δουλο,ω*. It is a strange fact too, that in Gothic the forms in *a* are masculine, those in *o* feminine.

On this subject it may be permitted to quote a passage containing a similar argument from Coleridge's 'Table Talk,' i. 119:—'Originally, I apprehend, in the 'Platt-Deutsch' of the north of Germany there were only two definite articles, *die* for the masculine and feminine, and *das* for the neuter. Then it was *die sonne* in a masculine sense, as we say *the sun*. Luther, in constructing the *Hoch-Deutsch* (for really his miraculous and providential translation of the Bible was the fundamental act of construction of the literary German), took for his masculine article the *der* of the Ober-Deutsch, and thus constituted the three articles of the present high German, *der*, *die*, *das*.'

Lastly, every language has the power of denoting gender by the addition of a distinct word, as in *jack-snipe*, *cock-sparrow*, *tom-cat*. This use of the names of men is seen in other languages besides our own. Thus the Anglo-Saxon employs *carl* for this purpose; and the suffix *erick*, or *erich*, or *erock*, would also appear to have been originally a proper name, though attached to the names of male birds, as *taub-erich*, *gänserich*, &c., in German. Violent corruptions of this form exist in our own tongue in *lark*, abbreviated from *laverock*, a term still used in Scotland; and *drake* from *andrake*, itself a corruption from *anat-erock*.

Many suffixes which denote simply an agent are erroneously supposed to include the idea of gender. Thus the word *spinster* is in modern use solely significant of a female; but this arises from the accident that in the olden time the duty of spinning was confined to the female. The same termination *ster* is seen in the old words *brewster*, *webster*, *bagster*, now more commonly expressed, at least in England, by *brewer*, *weaver*, *baker*; and these certainly belong not exclusively to the female.

Nothing has been said of suffixes to denote the neuter gender; simply because there exist, strictly speaking, no such suffixes. There are indeed appearances of such additions; first, in the Greek neuters *ἀγαθον* and the Latin *bonum*; secondly, in the neuter pronouns of the Latin language terminating with a *d*, which correspond to an *s* in German and a *t* in English; as *quod*, *was*, *what*; *id*, *es*, *it*, &c. Of the first class it is enough perhaps to throw out a suspicion that the letter *n* is merely an outgrowth from the preceding vowel *o*. [See O.] As to the second, if the letter had been really representative of the neuter gender, it ought to have run through the genitives and datives as well as the nominatives and accusatives; so that the Latin language, for instance, should have given us the forms *idius idi*, not *eius ei* for the neuter. The English form *its* is no answer to this objection, as it is well known that this little word has been but a short time naturalized. In the age of Shakspeare the only form for the neuter genitive was *his*, as appears in the original editions. But in fact it would be ridiculous to have a suffix to denote a negation.

GENDRE, LE. [LEGENDRE.]

GENEALOGY. [PEDIGREE.]

GE'NERA, in ancient Greek music, were of three kinds, —the Diatonic, Chromatic, and Enharmonic. [DIATONIC; CHROMATIC; ENHARMONIC.] These were subdivided into many species, which are enumerated by Gaudentius and Aristoxenus. 'Indeed,' says Sir J. Hawkins, 'the representations of the genera and their species, as well by diagrams as in words, are almost as numerous as the writers on music.' To that erudite historian of music we refer the reader who wishes for more information on a subject in which so few now take the slightest interest. The modern diatonic and chromatic genera, or scales, are probably much the same as, or nearly allied to, those of antiquity. Our Enharmonic is, practically—at least on most instruments—but a convenient evasion, the mere bestowal of two names on one and the same sound.

GENERAL, a title conferred on military men above the rank of field-officers. In all the states of Europe it indicates the commander-in-chief of the forces of the nation; the commander of an army or grand division, and also those who, under the latter, exercise his functions, with the particular designations of lieutenant-general and major-general.

The origin of the title appears in the history of France, in which country it seems to have been conferred on the commander of the royal army about the middle of the fifteenth century, when something like a regular military force was first established in Europe. The kings were then considered as holding the chief command of the army in virtue of their birth; and, on appointing persons under them to exercise a general superintendence of the forces, they gave to such officers the title of *lieutenant-general*, in order to designate at the same time the extent of their duties and their dependence on the sovereign whom they represented. By a decree made in the year 1450, in the reign of Charles VII., John, count of Dunois, was so qualified; and the title of lieutenant-general, denoting the immediate commander-in-chief of an army, was long retained in the French service. In the course of time, by an abbreviation in language, the prefix of the title was omitted, and the term *general* alone was applied to persons holding such command.

Previously to the epoch above mentioned the title of Grand Sénéchal of France appears to have conferred the right of commanding the royal armies; but the dignity being hereditary in the counts of Anjou, when that province passed to the crown of England in the reign of Henry II., the right ceased, and the kings of France delegated their authority to noblemen chosen at pleasure. In 1218 Philip Augustus conferred the command on Mathieu de Montmorenci, the constable of France; and the successors of that high officer held it till the re-formation of the army in the reign of Charles VII.

It must be remarked, however, that at a period more early than that of the creation of lieutenant-generals under the sovereign, the title of captain-general had been conferred on certain officers with military jurisdiction over particular districts. This species of command is supposed to have been first instituted in 1349 by Philip of Valois, who placed Guy de Nêle, already Maréchal de France, over the district of Xaintonge; within which he was authorised to inspect the castles and fortified towns, and to superintend all the military affairs. The nature of the duty therefore seems to have resembled that of the inspecting field-officers now appointed to particular divisions of this country and the colonies. But in 1635, that is, about eight years after the suppression of the post of constable of France, Louis XIII. gave the title of captain-general, for the army of Italy, to the duke of Savoy; and this appointment was precisely that of commander-in-chief, since it placed the duke above the maréchal de Créqui, who was previously at the head of the army.

It is about this time that the term lieutenant-general, in the sense which it now bears, first appears. For, according to Père Daniel, who quotes the history of Cardinal Richelieu for the fact, when the prince of Condé was made commander-in-chief of the army destined against Spain, the Marquis de la Force was appointed his *lieutenant-general*, and M. de Fouquières held the same rank under the Duc de Longueville, who was to act with an army in Franche-Comté. We have here but one lieutenant-general for each army: but the writer above mentioned observes that, during the reign of Louis XIV., the armies of France being much more numerous than before, the officers were also greatly multiplied; and adds that, in 1704, there were more than sixty who had the title of lieutenant-general.

The title of captain-general above mentioned must not be confounded with that which was created by Cardinal Riche-

lieu, in 1656, in favour of the Marquis de Castelnaut: this officer was placed above the lieutenant-generals of the army, but was subordinate to the marshal of France, who commanded in chief; and it appears that some of the former having retired from the service in disgust, in consequence of the new appointment, the cardinal was obliged to create others in their places.

In the reign of Francis I. the title of colonel-general was instituted; and it was first in 1544 conferred on M. de Taix, with the command of all the infantry of the nation. The title existed however only to the time of Louis XIV., by whom it was abolished.

The English nation has nearly followed the practice of France in matters appertaining to the military service. Thus the lord-high-constable and the lord-marshal of England, in former times, were at the head of the military establishments of the country; and, when the first office was suppressed by Henry VIII. in 1521, the title of captain-general appears to have been adopted for the commander-in-chief. This title occurs in the list of the army which served at St. Quintin in 1557, of which list a copy is given by Grose from a MS. in the British Museum. From the same list it appears that a lieutenant-general for the whole army was immediately subordinate to the former; and that under the last was a general of horse, a captain-general of foot, with his lieutenant, and a sergeant-major (corresponding to a present major-general). But the title of captain-general probably did not long remain in use; for, in the list of the army raised by Elizabeth in 1588, the highest officer is styled lieutenant-general, the queen herself being probably considered as the commander-in-chief. In the army which, in 1620, it was proposed to raise for the recovery of the Palatinate, and, in that raised by Charles I. in 1639, the commander is entitled the lord-general; a lieutenant-general appears as the second in command, and the third is designated serjeant-major-general. It was probably soon after this time that the last officer was called simply major-general; for we find that in 1656 Cromwell appointed twelve officers under that title to have civil and military jurisdiction over the counties of England. (Clarendon, b. 15.)

It is evident, from the histories of the northern states, that the armies in that part of Europe have always been commanded nearly in the same manner as those of France and England. Sir James Turner, who wrote his 'Military Essayes' in 1670, states that in Germany, Denmark, and Sweden, the commander-in-chief was designated feld-marshal, and that he had under him lieutenant-generals of the whole army, besides generals and major-generals of horse and foot. With respect to the first title, he considers it to have been granted, as a more honourable distinction than that of lieutenant-general, only within about fifty years from his time; and he appears to ascribe the introduction of it to the king of Sweden (Gustavus Adolphus), who, when he invaded Poland, thought fit to gratify some of his generals by designating them lieutenant-feld-marshals. (*Pallas Armata*, ch. 13.) From that time, both in Germany and Great Britain, such title, omitting the word lieutenant, has been considered the highest in the army.

In France, during the reign of Louis XIV., and perhaps at an earlier time, the naval commander immediately below the rank of vice-admiral was entitled lieutenant-general. A similar designation seems to have been early employed in the English service, for in the time of Queen Elizabeth the commander of a squadron was called the *general*; and, as late as the time of the Commonwealth, a joint commission of admiral and general was given to Blake and Mountague, though the expedition on which the fleet was sent was confined to an object purely naval.

The administration of military affairs in the great nations of Europe becoming highly complicated during the eighteenth century, the commanders-in-chief, even when not actually on the field of battle, found themselves fully occupied with the higher departments of the service; and it became indispensable that the number of subordinate generals should be increased, in order that all the steps which were to be taken for the immediate security of the armies, and for the acquisition of the necessary supplies, might be duly superintended by responsible officers. The division of an army, for the purpose of occupying important positions or of obtaining subsistence, led also to the appointment of several distinct commanders, each of whom required his own particular staff; and this circumstance, added to the necessity of having a number of officers prepared at once to assume the command of troops when circumstances should require it, will explain why military men holding the rank of general appear now to be so numerous.

In the British service there are about 75 full generals, and about 360 lieutenant and major-generals; but of this number many command particular regiments as colonels, or hold military governments in the country and colonies; many of them have only local rank; and many have retired from the service, retaining the title, but without receiving the pay or being qualified for obtaining any progressive promotion.

The *staff* of the whole military force of Great Britain consists of the general commanding-in-chief, the adjutant-general, and the quartermaster-general.

The duty of the adjutant-general falls partly under that of the sergeant-major-general in the sixteenth century: in the field he receives the orders from the general officer of the day, and communicates them to the generals of brigades; he makes a daily report of the situations of all the posts placed for the security of the army; and, in a siege, he inspects the guards of the trenches.

The quartermaster-general corresponds in part to the harbinger of the army in the sixteenth century. This officer has the charge of reconnoitring the country previously to any change being made in the position of the army; he reports concerning the ground which may be favourable for the site of a new encampment, and upon the practicability of the roads in the direction of the intended lines of route. He also superintends the formation of the encampment and the disposition of the troops in their cantonments.

The first notice of a commander of the artillery occurs in the time of Richard III.: this officer was designated simply master of the ordnance till 1603, when the earl of Devon was dignified with the title of general. The head of this department is now styled master-general of the ordnance.

GENERAL ASSEMBLY OF THE CHURCH OF SCOTLAND. This is the Scottish ecclesiastical parliament; it is a representative, legislative, and judicial body, which differs essentially in its constitution from the Convocation of the English church [CONVOCATION], in being composed of representatives of the laity, as well as of the clergy; and, therefore (like the British House of Commons), may be considered as a delegation from its constituency, the church. [CHURCH.] The following is the composition of the General Assembly:—

Eighty presbyteries, each of which consists of a certain number of parishes, varying from six to thirty-six, send to the Assembly 218 ministers and 94 elders; the city of Edinburgh sends 2 elders, and 65 other royal burghs send each one elder; the four universities send each a representative, and an additional one is sent from Marischall college, Aberdeen—these five may be either ministers or elders; one minister and one elder represent the churches in India in connexion with the church of Scotland. The kirk of Scotland has 1023 parishes, with 1050 ministers.

The General Assembly meets annually, in the month of May, in Edinburgh. The session lasts only ten days; but special business not decided within the period of the session may be referred to a commission, which is, in fact, the Assembly under another name; the commission can hold quarterly meetings. The speaker, or president of the assembly, is called moderator; he is chosen annually, and is, in modern times, a clergyman, it being a rule that the moderator should preach a sermon before the opening of the Assembly; but laymen have occasionally filled the chair. [BUCHANAN, GEORGE.]

Each parish in Scotland has its kirk session, composed of the minister and lay elders of the parish, which manages the parochial business. From the decision of the kirk session there is an appeal to the presbytery in which the parish lies. Each presbytery is composed of the ministers and elders of a certain number of parishes; but the presbyteries vary considerably in the number of parishes of which they are formed. A higher court, called a synod, is composed of two or more presbyteries. From the decision of a synod an appeal lies to the General Assembly, whose decision is final. The functions of the Assembly are analogous to a combination of the functions of both houses of

parliament. Its members speak and vote; it judges all matters connected with the government of the church; and it can proceed judicially against any member of the church, clerical or laical, for alleged impropriety or inconsistency of conduct or doctrine.

The connexion of the Church of Scotland with the State is indicated in the General Assembly by the presence of a functionary, who, under the title of lord-high-commissioner, represents the king or queen. The Scottish church however does not recognise the king or queen as head of the church, but as head of the state, with which the church is allied, for purposes of protection and civil authority. The lord-high-commissioner has no voice in the assembly; business is not necessarily interrupted by his absence; and his presence merely implies the sanction of the civil authority. On the conclusion of the session of the General Assembly, the moderator, after mentioning the day in the following year on which the Assembly meets again, dissolves the meeting in the name of the Lord Jesus Christ, the head of the church (sometimes the words 'the only head' are used), and then the lord-high-commissioner adds the sanction of the civil authority by appointing in the name of the king or queen the Assembly to meet on the day named by the moderator.

GENERALISSIMO, the commander-in-chief of an army which consists of two or more grand divisions under separate commanders. The title is said by Balzac to have been first assumed by Cardinal Richelieu, when he led a French army into Italy, and it has been since occasionally given to officers at the head of armies on the Continent, but it has never been adopted in this country.

GENERATING FUNCTIONS. The term *generating function* is a name given by Laplace to any function of x, considered with reference to the coefficients of its expansion in powers of x, as follows: if

$$\phi x = \psi 0 + \psi 1 . x + \psi 2 . x^2 + \ldots + \psi n . x^n + \ldots .$$

then ϕx is the generating function of ψn. Thus the generating function of n is $x \div (1-x)^2$, since the coefficient of x^n in the expansion of the preceding is n.

The theory of Generating Functions was investigated by Laplace, and it may be found in his 'Théorie des Probabilités,' or in Lacroix, 'Treatise on the Differential Calculus' (in the third volume of the quarto edition), or in the Appendix to the Cambridge translation of Lacroix. Its principal use is in the solution of equations of differences, and in the deduction of theorems connected with that subject.

GE'NESIS, THE BOOK OF, is the first of the five books of Moses, and derives its name from the principal event recorded in it, namely, the creation of the world and the human race, which in the Septuagint Greek translation is expressed by the word *Genesis* (Γένεσις) 'creation' or 'production.' In the original Hebrew it is named, according to the usual custom, from the first word in the book, *Bereshith* (בראשית) 'In the beginning;' it is not unfrequently cited by the Rabbins as *Sepher Yezirah* (ספר יצירה) 'The Book of the Creation;' and Josephus in his treatise against Apion (i. 8) called it 'the account of the creation of man,' (ἡ τῆς ἀνθρωπογονίας παράδοσις).

It has been thought by many critics that the Book of Genesis was not written by Moses. There are some passages in it which evidently could not have been the composition of Moses, since they refer to events which happened after his death. See c. xiii. 18, c. xxiii. 2, and c. xiv. 14, where Hebron and Dan are mentioned, which, we learn from other parts of the Bible, had different names in the time of Moses. See also Gen. xxxvi. 31, where an allusion is made to the kings of Israel, and a list is given (31—43) of the princes of Edom which is the same as the list given in Chronicles, I., c. i. 43—54. But these and similar passages might easily have been inserted in later times. Dr. Graves in his *Lectures on the Pentateuch*, and Faber in his *Horæ Mosaicæ*, vol. i. p. 305—336, show that there is no other period in the history of the Jews to which its composition can be so well referred. The preface to the first volume of the last edition of Rosenmüller's *Scholia* contains a fair view of the controversy; in which he gives many reasons for relinquishing the opinion he formerly held, that the book of Genesis was not written by Moses.

Supposing Moses to have been the author, it becomes an interesting question to ascertain in what manner Moses was enabled to give a faithful history of events which happened so many centuries before his own age. The book must have been composed in one of three ways: 1st, by immediate revelation of every circumstance from God; 2nd, by a collection of antient traditions; or 3rd, from former documents. The first supposition is generally abandoned in the present day by all theologians, with the exception of those who believe in the verbal inspiration of the Scriptures. The second, which is a common opinion amongst theologians in this country, would not injure the credibility of the book; since Lamech, the father of Noah was contemporary with Adam, Shem the son of Noah lived in the time of Abraham, his son Isaac was contemporary with Joseph, and some of the contemporaries of Joseph might have known Moses; so that few persons were required for the transmission of the traditions. The third opinion is the one generally received by the German theologians of the present day, and was maintained by many former writers. (See Carpzov., *Introd.*, part i. p. 57; Vitringa, *Observ. Sacr.*, l. i., dissert. i., c. 4.; Le Clerc, *Proleg.*, dissert., iii. p. 30; Calmet, *Commentaire Littéral*, vol. i., part i., p. 13.) Astruc believed that this book of Moses was composed from twelve such documents. (*Conjectures sur les Mémoires Originaux dont il paroit que Moise s'est servi pour composer le Livre de Genèse*, 1753.) Ilgen reduced the number to three (*Die Urkunden des ersten Buchs von Moses in ihren Urgestalt*, 1798); and Eichhorn in his 'Introduction to the Old Testament,' vol. iii., p. 42—135, maintains there were only two. There is however considerable difficulty in assigning the number, though there are strong reasons for believing that the general hypothesis is correct. Our limits will only permit us to give two examples. It is supposed that the first three chapters were composed from two separate documents; one containing the first chapter and the first four verses of the second, the other the remainder of the second chapter and the whole of the third. The second document, which begins with the words, 'These are the generations of the heavens and the earth,' contains another account of the creation, which would hardly have been given again after the full account of the same event in the first chapter, if all three had been written by one person. In addition to this, the name of the Deity is different in the two documents; in the first he is invariably called *Elohim* (אלהים), and in the second *Jehovah Elohim* (יהוה אלהים). The frequent repetition of the same circumstances in the history of the Deluge have induced critics to believe that it was composed from two documents. Compare vi. 5, with vi. 12; vi. 9, with vii. 1; vi. 19, 20, with vii. 2, 3; vi. 17, with vii. 4; vi. 22, with vii. 5; vii. 6—9, with vii. 11—16; vii. 18, with vii. 19; vii. 21, 22, with vii. 23; viii. 21, 22, with ix. 8—11. The whole of the book of Genesis is divided by Eichhorn, in his 'Introduction to the Old Testament,' and by Jahn, in his 'Hebrew Bible,' (Vienna, 1806), into the original documents from which they believed it was compiled. Dr. Lamb, in his work on 'Hebrew Letters taken from Hieroglyphics,' supposes, without a shadow of reason, that Moses copied the first eleven chapters from hieroglyphics.

The book of Genesis may be divided into two parts; the first extending from the beginning of the book to the 9th verse of the 11th chapter, and the second containing the remaining chapters. The object of the author was to give the history of the Jews from the earliest times; and the first part, which contains the history of the world from the creation to the birth of Abraham, is merely introductory. The real history commences with his birth, preceded by a genealogical table of his pedigree.

I. The first part (i.—xi. 1—9,) gives an account of the creation and of the institution of the Sabbath (i. ii. 1—3); of the fall of man and his expulsion from Paradise (ii. 4—25, iii.); of the history of Adam and his descendants till the Deluge (iv. v.); of the Deluge (vi. vii.); of the restoration of the world (viii.); of the history of Noah and his sons (ix.); of the peopling of the world by his descendants (x.); and of the confusion of tongues and dispersion of mankind (ix. 1—9). Many theologians, from a supposed difficulty in the literal interpretation of the first three chapters, have supposed them to be *mythical*. The arguments for such a mode of interpretation may be seen in Seiler's *Biblical Hermeneutics*, transl. by Dr. Wright, p. 163—169. To this it is replied that the style is purely historical, that the difficulties are imaginary, and that the writers of the 'New Testament' refer to the events contained in the first three chapters as real transactions. (Mat. xix. 4; John viii. 44; 1 Tim. ii. 13, 14; 2 Cor. xi. 3; 1 John, iii. 8.)

The positive enactments of the patriarchal religion were few and were all retained in the laws of Moses. They related to the Sabbath (ii. 3; viii. 10—12), to sacrifices (iv. 3, 4), and to abstinence from the flesh of animals with the blood in it (ix. 3, 4).

II. The second part (xi. 9, to the end of the book) gives an account of the family of Abraham and his journeys into Canaan and Egypt (xi. 10—32, xii.); of the wanderings of Lot and Abraham in Canaan (xiii.); of the defeat of the four kings by Abraham (xiv.); of the promise of God to Abraham (xv.); of the birth and early life of Ishmael (xvi.); of the institution of circumcision and the renewal of the promise (xvii.); of the destruction of Sodom and Gomorrah (xviii., xix.); of the sojourning of Abraham at Gerar and the birth of Isaac (xx., xxi.); of the trial of Abraham (xxii.); of the death of Sarah (xxiii.); of the marriage of Isaac (xxiv.); of the birth of Esau and Jacob (xxv.); of the history of Isaac (xxvi., xxvii.); of the departure of Jacob to Padan-Aram, and of his return to Canaan (xxviii.—xxxiii.); of the cruelty of Simeon and Levi to the Shechemites (xxxiv.); of the death of Isaac (xxxv.); of the history of Esau and his descendants (xxxvi.); of the selling of Joseph into Egypt (xxxvii.); of the incest of Tamar (xxxviii.); of the history of Joseph in Egypt (xxxix.—xlv.); of the descent of Jacob into Egypt, and his settlement there with his family (xlvi.—xlix.); and of the death of Jacob and Joseph (l.).

The chronology of the book of Genesis has occasioned great difficulty. This arises from the difference of the Hebrew text from the Septuagint. According to the Hebrew text the deluge happened A.M. 1656, according to the Septuagint A.M. 2262; the former giving B.C. 4004, and the latter B.C. 5411, as the epoch of the creation. Dr. Hales, with many other critics, considers the dates of the Septuagint to be more in accordance with profane history and with the various events related in the first chapters of Genesis. Our limits prevent us from giving an account of the controversy; we can only refer to the arguments in Dr. Hales' *Analysis of Chronology*, vol. i. 273—303, and Clinton's *Fasti Hellenici*, vol. i., p. 283—301; the latter of whom defends the chronology of the Hebrew text, and observes with much justice that there does not appear any sufficient reason for inducing the Jews to change the numbers, while the translators of the Septuagint were naturally anxious to make the epoch of the creation more conformable with the high pretensions of the Egyptians and Chaldæans. From the Deluge to the common date of the birth of Abraham, the Hebrew text gives 292 years, the Septuagint 1072. This date is given on the authority of Gen. xi. 26, 'And Zerah lived 70 years, and begat Abram, Nahor, and Haran.' But there is sufficient reason for believing that Abraham was not born till 60 years afterwards, and that his name is only placed first on the catalogue on account of his celebrity, not because he was the first-born. Adding 60 years to the former numbers we obtain the birth of Abraham, according to the Hebrew text A.M. 2008 or B.C. 1996; according to the Septuagint, as corrected by Dr. Hales and Mr. Clinton, A.M. 3258 or B.C. 2153. Having obtained the birth of Abraham, there is no great difficulty in ascertaining the dates of the principal events that follow. The following table is abridged from Clinton's 'Fasti Hellenici;' the dates are reckoned from the birth of Abraham:

Birth of Abraham, in 130th year of Zerah. Gen. xi. 32, xii. 3—5, compared with Acts vii. 4.

10. Birth of Sarah, ten years younger than Abraham. Gen. xvii. 17.
75. The call of Abraham. Gen. xii. 1—4.
86. Birth of Ishmael. Gen. xvi. 16.
100. Birth of Isaac. Gen. xvii. 17.
137. Death of Sarah, at the age of 127. Gen. xxiii. 1, 2.
140. Marriage of Isaac, at the age of 40. Gen. xxv. 20.
160. Birth of Esau and Jacob. Gen. xxv. 26.
175. Death of Abraham. Gen. xxv. 7, 8.
237. Jacob goes to Haran at the age of 77.
257. Jacob returns to Canaan. Gen. xxxi. 41.
268. Joseph, at the age of 17, sold into Egypt. Gen. xxxvii. 2.
280. Death of Isaac, at the age of 180. Gen. xxxv. 28.
281. Joseph, at the age of 30, governor of Egypt. Gen. xli. 46.
290. Jacob, at the age of 130, goes into Egypt. Gen. xlvii. 9.
307. Death of Jacob, at the age of 147. Gen. xlvii. 28.
360. Death of Joseph, at the age of 110. Gen. l. 26.

The following passages are supposed by most Christian divines to be prophecies relating to Christ:—iii. 15; xii. 3; xviii. 18; xxii. 18; xxvi. 4; xxviii. 14; xlix. 10.

(Eichhorn's *Einleitung in's Alte Testament*, vol. iii. p. 18—176; Augusti's *Grundriss einer historisch-kritischen Einleitung in's Alte Testament*, p. 157—162; Faber's *Horæ Mosaicæ*; Graves *On the Pentateuch*; Rosenmüller's *Scholia*; Holden's *Dissertation on the Fall of Man*; Horne's *Introduction to the Scriptures*, vol. iv. p. 3—9.)

GENESSEE. [NEW YORK.]

GENETTA (Zoology), Gennet. [VIVERRIDÆ.]

GENE'VA, GENE'VE (*Genf* in German, *Ginevra* in Italian), a town and canton of the Helvetic Confederation, situated at the south-west extremity of Switzerland, is bounded on the north by the canton of Vaud and the Leman Lake, on the east and south by Savoy, and on the west by the French department De l'Ain. It consists of the territory of the old republic of Geneva, of the district of Versoix ceded by France, and of the districts of Carouge, Hermance, and others, ceded by the king of Sardinia by the treaties of Paris, 1814, and of Turin, 1816. The area of the canton is reckoned at about 93 square miles, it being the smallest canton in Switzerland, though by no means one of the lowest, either in population, industry, wealth, or political importance. The population of the canton amounted, according to the census of 1834, to 56,655 inhabitants, of whom 27,177 were in the town of Geneva. Of the inhabitants of the town about 17,000 were Genevese by birth, 5000 were Swiss of other cantons, and the rest were natives of France, Savoy, Italy, Germany, and other countries, among whom were two or three hundred English. The greatest length of the canton is about 17 miles, from Hermance, on the extreme north-east frontier, towards the Chablais, to Chancy, a commune on the left bank of the Rhône, south-west of Geneva, near the Fort de l'Ecluse, which is a French military outpost on that side.

The territory of Geneva extends along both banks of the lake and the valley of the Rhône, being confined on the west by the lower offsets of the Jura, and on the east and south-east by the mountains of Voirons and Salève, which are about 4000 feet above the sea. These mountains however are out of the territory of Geneva, which contains only some hills, the highest of which are not 400 feet above the level of the lake. The territory of the canton is divided into three districts:—1. The district north of the Rhône, including a strip of land along the west bank of the lake as far as the borders of the canton of Vaud, beyond Versoix. 2. The district south of the Rhône, and between it and the left bank of the Arve, which includes Carouge, a neat well-built town, with 4000 inhabitants, about one mile south of Geneva. 3. The district north of the Arve, and between it and the east bank of the lake, along which it extends in a narrow strip as far as Hermance. The principal place of this last district is Chesne, consisting of two large villages adjoining each other, which reckon together about 2000 inhabitants. Numerous other villages are scattered about the whole territory; and the immediate neighbourhood of Geneva, both along the banks of the lake and in the direction of the principal avenues leading to the town, exhibits extensive lines and groups of country-houses, which form handsome suburbs.

The territory of Geneva, though not naturally fertile, is rendered productive by the industry of the inhabitants: about one-third of it is sown with corn, another third is pasture-land, a much smaller proportion is planted with vines, which yield an indifferent sort of wine; the rest consists of woods, orchards, and gardens. In 1835 there were about 7650 head of cattle. The deficiency in corn, cattle, and wine, for the consumption of the town of Geneva, is supplied by the neighbouring countries.

Manufactures, and the employment of capital in foreign funds, banking and exchange, and commercial speculations, form the principal sources of wealth of the Genevese. There are among them many capitalists; and Geneva, which is the most populous town of Switzerland, is also the wealthiest, with the exception perhaps of Basel. Industry, calculation, and economy are characteristics of the people in general. Watches and jewellery are now the principal manufactures: about 100,000 watches are made annually and exported to France, Italy, the Levant, and other countries. This branch of industry employs nearly 2000 individuals, and jewellery nearly 1000 more. There are in

the town about 1600 tradespeople, and about 2500 servants, of whom 1900 are foreigners, chiefly from Savoy and the canton De Vaud.

Three-fifths of the population are of the Reformed or Calvinist communion; the rest are Catholics, the number of whom, formerly consisting chiefly of foreign residents, has much increased since 1814 by the incorporation of the ceded districts of France and Savoy. The town of Geneva is divided into 14 parishes; and the old territory of the republic, which is mostly inhabited by Protestants, into 14 more. The Catholic rural districts contain 28 parishes, which are included in the diocese of Freyburg, whose bishop styles himself bishop of Lausanne and Geneva. In the town of Geneva there is a Catholic church, the curate of which superintends the Catholic families scattered about the town. The Jews have a synagogue at Carouge, but they have not the freedom of the city of Geneva.

The roads of the canton are kept in very good order by the State Government, at the annual expense of 136,000 florins (the Geneva florin is about 4½*d.*). The other principal heads of expenditure are administrative and judicial departments, 310,000 florins; support of the Protestant clergy, 135,000; ditto of Catholic clergy, 92,000; public instruction, 230,000; military, 525,000, police and prisons, 200,000; pensions, 30,000; emoluments of the deputies to the Diet and other expenses for federal objects, 30,000; public works, 90,000 florins. The revenue of the canton amounts to about 2,000,000 florins, derived from the following sources: land and house-tax, 204,000 florins; stamps, registry of sales, and deeds and mortgages, and legacy-duty, 950,000; income tax, called tax des gardes, 189,000; post-office, 169,000; customs, 144,000; monopoly of salt, 214,000; tax upon servants, 45,000; patents and licenses, 35,000; tolls at the gates, 39,000. All this is exclusive of the municipal taxes of the city of Geneva.

There are 41 elementary schools in the various communes of the canton, attended by about 3860 children. For administrative purposes the canton, exclusive of the capital, is divided into 37 communes, of which 15 belong to the old territory of the republic, 16 have been dismembered from Savoy, and 6 ceded by France. In every commune there is a municipal council, elected by the inhabitants above 21 years of age, and who pay at least two florins of direct taxes. The council is presided by the maire, who is appointed by the council of state.

The canton is bound to furnish to the Swiss Confederation, when summoned by the Diet, a contingent of 2 battalions of infantry, 3 companies of artillery, and a company of cavalry; in all, 1760 men. The militia of the canton, including all citizens from 20 to 45 years of age, and amounting to about 5500 men, is exercised and reviewed every year. Besides these there is for the service of the town and the police a garrison of 120 salaried artillery-men, and 80 gendarmes, almost all foreigners. The arsenals of the canton contain 79 pieces of artillery, and 3900 muskets.

Geneva is one of the oldest sites in Western Europe. It is mentioned in the Gallic War of Cæsar (1. 7).

The republic of Geneva originated in the municipal government of the town, to which Charlemagne granted certain privileges and franchises, subordinate however to the bishop, who was styled Prince of Geneva and was an immediate feudatory of the empire. Frequent dissensions occurred between the citizens and the bishop on one side, and the counts of Genevois, 'Comites Gebennenses,' or 'Genevensium,' a feudal dynasty grown out of the wreck of the old kingdom of Burgundy, and which ruled the adjoining province of Savoy, which is still called Genevois or Genevese, and of which Annecy is the capital. These counts claimed jurisdiction over the town of Geneva. The line of the counts of Genevois becoming extinct in the fourteenth century, their inheritance escheated to the house of Savoy, who obtained the investiture of it from the Emperor Sigismund in 1422; and hence are derived the claims of the dukes of Savoy over Geneva, claims however never completely enforced. At the Reformation the bishop quitted Geneva, and retired to Annecy, and from that epoch the town governed itself as an independent municipality, and formed an alliance with the Swiss cantons of Bern and Freyburg, and afterwards Zürich. The dukes of Savoy, after several fruitless attempts to reduce Geneva by force or surprise, acknowledged its independence by the treaty of St. Julien in 1603.

In the eighteenth century Geneva was distracted by interior feuds between the popular party, or représentans, and the aristocratic families, or négatifs. [DELUC.] These troubles furnished the French Directory with a pretence for seizing it by force, and incorporating it with France in April, 1798. It then became the head town of the new department 'Du Léman.' In 1814 it was occupied by the Austrians, and was restored by the allied powers to its independence as a canton of the Swiss Confederation, to the great satisfaction of its inhabitants.

The town of Geneva is built on two hills divided by the Rhône, where it issues out of the Leman lake, the higher of which, on the south bank of the river, is about 100 feet above the lake. The larger part of the town lies on that side. The river forms an island within the town, which is also built upon and is a separate district, joined to the two banks by bridges. The district on the north bank is called St. Gervais. A smaller island, at the very point where the Rhône issues from the lake, is planted with trees and forms a public promenade, which is adorned with the statue of Rousseau. A handsome suspension-bridge has been lately thrown across the river to connect both banks and the island. A handsome quay with fine buildings has also been constructed along the south bank of the river. The streets in the old part of the town, or cité, as it is called, are narrow and steep, the houses high, and the appearance of the streets rather gloomy. The most remarkable buildings are, 1, the church of St. Peter, the handsome front and portico of which were restored in the 18th century; 2, the Hôtel de Ville, which is a very old and massive building; 3, the hospital; 4, the Musée Rath, which has some good paintings; 5, the College, with a library of 50,000 volumes; 6, the Botanic Garden; 7, the Observatory; 8, the new Hôtel des Bergues, one of the largest and finest in Europe; 9, the Penitentiary, where a strict discipline is enforced; the convicts work together in silence, and are separated for the night. The illiterate are taught to read and write There is another prison for individuals waiting for trial, or condemned for misdemeanors by the correctional police. The town is regularly fortified with ramparts, ditches, and bastions, but is commanded by the hills of La Batie and St. Jean, which makes it unfit to stand a regular siege. There are three gates, two on the Savoy or south side, and one on the French or Swiss side.

The municipal expenditure of the town amounts to about half a million of florins annually, the revenue being derived chiefly from the octroi, or duty on provisions levied at the gates. Geneva abounds with means of instruction. There is the Academy or University, with four faculties—theology, law, sciences, and belles lettres, with forty professors; the schools of drawing and architecture, mechanic schools (écoles industrielles) where they teach mathematics, physics, and chemistry, applied to the arts; a school for music; a school of gymnastics; a school for watchmakers' apprentices; besides elementary schools, infant schools, and other schools both public and private. There are also societies of arts, of medicine, of physics, and natural history, a mechanics' society, a military society, and a reading society, which has a library of 30,000 volumes, receives foreign journals and papers, and has about 300 subscribers; a museum of natural history, which is very rich; a cabinet of medals, a botanical garden, under the direction of Professor De Candolle, and other scientific institutions.

It would be difficult to name a town of equal size which has produced so many illustrious men as Geneva. The most distinguished names are those of Turretin, Diodati, Tronchin, Burlamaqui, Godefroi, Leclerc, Bonnet, Saussure, Deluc, Pictet, Odier, Trembley, Sénebier, Delolme, Dumont, Say, Mallet, Rousseau, Madame de Stael. Among the living are Sismondi, Lullin de Châteauvieux, De Candolle, Huber, the engineer Dufour, Prevost, &c.

The social and moral state of Geneva bears still, after a lapse of three centuries, marks of the strong impression which John Calvin stamped upon it. He found a society disjointed, disorderly, ignorant, and licentious; and left it at his death orderly, religious, moral, and patriotic. A mere speck on the map of Europe, exposed to the political and religious antipathies of its powerful neighbours of France, Savoy, and the Spanish government of Lombardy, an object of the fixed hostility of the Court of Rome, Geneva withstood all attacks through the public spirit of its citizens and the wisdom and policy of its councils. Henry IV. of France protected it. It was assisted by Bern and Zürich against the Dukes of Savoy, and the States of Holland, the Protestant

princes of Germany, and the government of Great Britain interested themselves in its favour. By these means Geneva maintained its political and religious independence, and was looked upon as the rallying point of the Reformed communion in western Europe, so as to be styled by some the 'Rome of the Protestants.' It supplied the Reformed churches of France with pastors and teachers, and when Louis XIV. persecuted his Reformed subjects, many of them found an hospitable asylum within its walls. Religious emigrants from Italy came also to swell the number of its citizens. Even to this day it is considered as a sort of metropolis by the Reformed or Calvinist churches of the Continent. Religious dissent however has broken out within its own bosom. A party of zealous religionists have arisen, who seem to charge the majority of the clergy of Geneva with having forsaken the tenets of their Reformer. This party have their chapels, their own school of theology, and they form an association known by the name of the Evangelical Society. Much has been written upon this controversy, and the clergy of Geneva have had a defender in the Rev. J. L. Pons: 'The Doctrine of the Church of Geneva, illustrated in a series of Sermons preached by the modern Divines of that City,' 2 vols. 8vo., 1832. The clergy of Geneva are under the discipline of a synod, called La Compagnie des Pasteurs, presided by a moderator who is changed annually.

By the present constitution of Geneva the council of state, or executive of twenty-four members, has alone the initiative of laws. The projects of laws are laid before the representative council, consisting of 274 members, which accepts or refuses, and may make amendments, with certain restrictions. The members of the representative council are elected for nine years by all the citizens, that is to say, all the natives of either town or territory above twenty-five years of age, who pay seven florins of direct taxes, and who are neither paupers, bankrupts, nor servants, and have not been condemned in any criminal process. The representative council names the members of the council of state for eight years; it also fixes the annual budget of the canton, and also the municipal budget of the town, and appoints the judges and magistrates. The sittings of the representative council are public. The liberty of the press is guaranteed. (Lereschc, *Dictionnaire Geographique de la Suisse.*)

A good account of the old republic of Geneva, of its domestic troubles and external affairs, is given in Berenger, *Histoire de Genève*. Sénebier has written an account of its learned men: *Histoire Littéraire de Genève*. Cox, in his 'Travels,' has given a sketch of its antient constitution, and numerous other travellers have described the peculiarities of this little state.

Geneva is 33 miles south-west of Lausanne, and 80 miles south-west of Berne.

GENEVA, LAKE. [LEMAN, LAKE.]

GENEVA, a spirituous liquor, which is frequently confounded with gin. It is however a fermented liquor, which bears the same relation to gin as wine does to any distilled spirit. It is procured by the fermentation of the berries of the Juniperus communis. These berries consist of a peculiar saccharine principle (which exists to the amount of about 33 per cent. along with acetate of lime), and a volatile oil, which is contained in ten peculiar cells, which lie close to the seeds; as the oil assumes a resinous state in old berries, these cells may be easily seen in such specimens. The green one-year-old berries contain much more volatile oil, and are to be preferred to the ripe berries. The oil rarely exceeds 1 per cent. From the quantity of sugar which they contain they can easily be caused to ferment and yield a spirit, or vinegar may be made from them. Geneva is a very powerfully stimulating liquor, containing a large proportion of alcohol. The volatile oil having a special action on the kidnies renders it the most proper cordial in cases of dropsy from debility, or even connected with diseased heart, when the system requires support. The flavour is attempted to be communicated to English gin, by adding oil of turpentine to brandy; but it is very inferior.

GENEVRE, MONT. [ALPS.]

GENGIS KHAN was the son of a Mogul chief named Pisoucay or Yesoucay, who ruled over thirty or forty thousand families. He was born A.H. 559 (A.D. 1164), at a place called Blun Yulduck. His original name was Temugin, which he exchanged for that of Gengis Khan, *i. e.* 'Khan of Khans,' when he became the supreme ruler of the Moguls and Tartars.

Gengis Khan was early trained to the art of war. His father died when he was in his fourteenth year; and the neighbouring princes took advantage of his youth to invade his dominions. At this early age he marched in person against his enemies, but was obliged to retreat, and fled for protection to Oungh, the powerful Khan of the Keraites, who was known in Europe under the name of Prester John. [PRESTER JOHN.] Gengis Khan remained for many years in the court of Oungh Khan, who gave him his daughter in marriage, and advanced him to the highest dignities in his kingdom. Gengis Khan at length incurred the suspicions of his patron, and orders were given for his arrest. He escaped this danger, and returned to his own dominions, where he defeated the troops that were sent against him, and persuaded many of the Mogul hordes that were subject to Oungh Khan, to rebel against his authority. Oungh Khan marched in person against them, but was entirely defeated by Gengis Khan, A.H. 599 (A.D. 1202), who obtained the dominions of his father-in-law in consequence of this victory. He next conquered the Naimans, and compelled the most celebrated of the Mogul and Tartar chiefs to submit to his authority. Having thus united the various hordes that wander over the steppes of Central Asia, he summoned a great council consisting of Mogul and Tartar chiefs, in which he was proclaimed *Khan* of the whole nation, A.H. 602 (A.D. 1205). In the same assembly he disclosed his intention of invading China and Southern Asia, and pretended to have received from heaven a commission for the conquest of the world. With this object in view, he published a code of laws, and introduced stricter discipline into the army, which he divided into bodies of tens, hundreds, thousands, and tens of thousands; called respectively in the Mogul language *Dehe*, *Sede*, *Hezare*, and *Toman*. Before he could carry his projects into effect, he was obliged to defend himself against those Mogul chiefs who refused to submit to his sovereignty. These chiefs were subdued in the course of five years; and Gengis Khan was at length able to commence his career of conquest. China first experienced the devastations of the Moguls, A.H. 607 (A.D. 1210); but a temporary peace was concluded between the two countries, and the daughter of the king of China was married to Gengis Khan. Three years afterwards another Mogul army invaded the country, and after defeating the Chinese, took the city of Pekin. The northern provinces of China were from this period annexed to the Mogul empire.

The most powerful monarch in southern Asia at this time was Mohammed Kothbeddin, king of Carizme, whose ancestors had established an independent monarchy on the decline of the power of the Seljuke Sultans. [SELJUKIDES.] He ruled over almost all the countries of southern Asia from Syria to the Indus, and had demanded of the Abbaside Caliph to be allowed to reside at Bagdad as *Emîr al Omara*, a dignity which had formerly belonged to the Seljuke Sultans. This demand was refused; and the Caliph fearing the power of Mohammed, sent an ambassador to Gengis Khan to implore his assistance. Gengis Khan did not immediately comply with the Caliph's request; but anxiously waited for some act of hostility on the part of Mohammed to justify him in breaking the peace which then subsisted between them. This was soon given him by the murder of some Mogul ambassadors and merchants at Otrar, a town on the Jaxartes, in the dominions of Mohammed. Gengis Khan collected all his forces, and with an army of 700,000 men, according to Oriental historians, advanced to the Jaxartes, A.H. 615 (A.D. 1218). Near this river he was met by Mohammed with an army of 400,000 men, and though the issue of the battle was doubtful, Mohammed dared not hazard a second contest, but retreated to the south after placing strong garrisons in all the fortified towns. The conquest of Transoxiana was completed in two years, and all its cities taken, after an obstinate resistance. A body of 30,000 men was sent into Khorasan to pursue Mohammed, who escaped to an island in the Caspian Sea, where he died shortly afterwards.

In A.H. 618 (A.D. 1221) Gengis Khan advanced castward and entered the city of Balkh, whose inhabitants he massacred on account of the assistance they had rendered to Gelal-eddin, the son of Mohammed. While he was engaged in the conquest of the neighbouring countries, he sent part of his forces to subdue Khorasan, part to conquer the western provinces of Persia, and an army of 80,000 men to pursue Gelal-eddin, who had fled into the countries west of the Indies. These expeditions were successful, with the

exception of the last. Gelal-eddin, who appears to have been a brave and enterprising prince, defeated the Moguls, but was soon afterwards conquered by Gengis Khan, who had marched in person against him. In the two following years the lieutenants of Gengis Khan conquered Azerbijan and all the other provinces of the Persian empire. In A.H. 620 (A.D. 1224), he again crossed the Jaxartes, and returned to his capital, Cara-corom, after an absence of seven years, during which period he had laid waste the most fertile regions of Asia, plundered the cities of Carizme, Herat, Balkh, Candahar, Bokhara, Samarcand, and many others of less note, and destroyed, according to the calculation of Oriental historians, five millions of human beings. His empire now extended from the Volga to the Pacific, and from Siberia to the Persian Gulf; but he still meditated new conquests, and in the following year led his victorious Moguls through the desert of Gobi against the King of Tangut, whom he defeated and subdued. He then continued his march towards the southern provinces of China, but died on the borders of that country on the 10th of Ramadhan, A.H. 624 (24th August, 1227), in the sixty-fourth year of his age. He was succeeded by his son Octai. His two other sons had the provinces of Transoxiana and Khorasan assigned to them. The Mogul princes have always claimed descent from the family of Gengis Khan; but his descendants lost all real power, though they still retained the title of Khan, in the time of Tamerlane. [TAMERLANE.]

The code of laws published by Gengis Khan is still known in Asia under the title of *Isa Gengis Khani*, 'The Laws of Gengis Khan.' An interesting account of them is given by M. Langlès in the fifth volume of *Notices et Extraits des Manuscrits de la Bibliothèque du Roi*.

(Petit de la Croix's *History of Genghizcan the Great*, Eng. Trans.; De Guignes, *Histoire des Huns*, vol. iii.; D'Herbelot, *Bibliothèque Orientale*, arts. *Genghiz Khan*, *Mohammed Kothbeddin*, &c.; Gibbon's *Decline and Fall*, c. lxiv.)

GENII, called in the East *Ginn* (Arabic جن), are supposed to be a race of beings created from fire, capable of assuming any form and becoming invisible at pleasure. All Moslems are obliged to believe in their existence, since they are said in the Koran (c. vi.) to be created by God. It is imagined that they inhabited this world many ages before man was created, and were governed by forty successive monarchs of the name of Solomon, the last of whom was called Gân Ebn Gân, and that from him they derived their name. It is also said that they frequently rebelled against God, who at length deprived them of their possessions and gave them to man. We learn from the Koran (c. 72) that many of these wicked spirits were converted by hearing Mohammed reading a portion of it, and that those who continue unbelievers (called, in c. 27, *Ifrît*) will be condemned to the fires of hell. They are believed to take great interest in human affairs, and to be the authors of much happiness and misery to mankind. (An interesting account of the superstitions of the modern Arabs respecting Genii is given in Lane's *Modern Egyptians*, vol. i. 283—290; ii. 164—166.)

GENITIVE. [ABLATIVE CASE.]

GENIUS, in its original acceptation, denoted the tutelary god or dæmon which, according to an antient and common superstition, was allotted to every individual at his birth, to guide and rule him during life, to preside over his fortunes and destiny, and eventually to lead him from existence; and it was supposed that the variety observable in the characters and capacities of different men was dependent upon the higher or lower nature of their attendant genii. Afterwards the word came to signify the disposition itself, without reference to its supposed cause; and lastly, in modern times it has been employed, in a restricted but peculiar sense, to designate either that high mental pre-eminence which is occasionally found in a few individuals, or, by a metonymy, the person possessed of such rare excellence.

Like every thing else that is truly beautiful and great, Genius has in it a something undefinable; and hence the variety of notions as to its origin and nature, in all of which there is and must be something deficient. Dr. Johnson's definition ('Life of Cowley,') is this: 'The true genius is a mind of large general powers accidentally determined in some particular direction.' Generally it is understood to be the perfection of human intelligence. And as this consists in the highest possible activity of the mental energies, genius is essentially creative, and all its productions are indelibly stamped with the impress of originality and grandeur. It is at once a law and a model to itself; it produces what has never before been accomplished, and which all, in all ages, are constrained to admire. It receives therefore its impulse from enthusiasm, for nothing great can be accomplished without that enthusiasm which is enkindled by some dominant idea, to which all else is made subordinate and postponed; and its chief faculties are the reason and the imagination, which alone are inventive and productive.

But according as one or other of these faculties predominates, Genius becomes either scientific or artistic. In the former case it seizes at once those hidden affinities which otherwise do not reveal themselves, except to the most patient and rigorous application; and as it were intuitively recognising in phenomena the unalterable and eternal, it produces truth. In the latter, seeking to exhibit its own ideal in due and appropriate forms, it realises the infinite under finite types, and so creates the beautiful.

But even the most eminent genius must duly form and develop itself by a careful contemplation of the beautiful and true which the great geniuses of past time may have created and discovered. It is by looking exclusively to this circumstance, that those who deny any original inequality among men have been led to maintain that what is called genius is simply a result of education and culture; while on the other hand an equally partial consideration of those extraordinary powers which have occasionally been exhibited in totally uneducated minds, and under the most unfavourable circumstances, has deceived the zealous partizans of original genius.

In active life the grand and ambitious designs of successful statesmen and conquerors are often ascribed to genius, but they belong more properly to the energy of the will than to that of the intellect, to force of character rather than to power of mind.

The phrase 'universal genius,' in order to be legitimate, requires to be limited in one or other of its terms. When applied to a Fontenelle we must restrict the signification of genius to the power and capacities of the human mind in general; and it is only by confining the term universal to all the subordinate branches either of art or science, that it is even allowable to ascribe it to the genius of a Michael Angelo or a Leibnitz.

Genius and fancy are often confounded: the latter is undeniably a pre-eminent capacity, but it exerts itself rather to imitate than to invent, and is devoid of all enthusiasm.

Consult Sharpe's 'Dissertation on Genius,' London, 1755; Duff's 'Essays on Original Genius, and its various Modes of Exertion in Philosophy and the Fine Arts,' London, 1767; and 'Lælius and Hortensia, or Thoughts on the Nature and Objects of Taste and Genius,' Edinburgh, 1782.

GENLIS, STEPHANIE FELICITE DUCREST DE ST. AUBIN, COUNTESS DE, was born near Autun in 1746, of a respectable but not rich family. She became at an early age a proficient in music, and her skill as a player introduced her to some persons of distinction, in whose company she had an opportunity of studying the manners and adopting the language of refined society. Her first writings exhibited a remarkable elegance and fluency of diction, which attracted attention, and excited the interest of the count de Genlis, who married her. She was soon after entrusted with the education of the children of the duke of Orleans, and one of her pupils, Louis Philippe, is the present king of the French. In the course of her task, to which she brought great assiduity and zeal, she wrote several works for the use of her pupils, which were afterwards published, namely, 'Les Veillées du Château,' 'Les Annales de la Vertu,' 'Le Théâtre de l'Education,' 'Adèle et Theodore,' &c. These rank among her best and most useful works, and they have had and still have a deserved popularity. After the French revolution broke out, Madame de Genlis, who had been at first its partizan, was obliged to seek safety in flight; she went successively to England, Belgium, Switzerland, and lastly to Hamburg, followed everywhere by the suspicions which her avowed sentiments, her connexions with several leading revolutionists (among others with Lord Edward Fitzgerald, who married her adopted daughter Pamela), and the slander of the royalist emigrants, raised against her. At Hamburg she wrote a kind of political work styled 'Les Chevaliers du Cygne,' which did not add to her reputation either as an author or a moralist. She afterwards attempted

a justification of her own conduct and sentiments, 'Précis de la Conduite de Madame de Genlis.' She returned to France under the consulship of Bonaparte, who had a favourable opinion of her talents, and she became one of his admirers and panegyrists. After her return to Paris she wrote 'De l'Influence des Femmes sur la Littérature,' in which she replied to the attacks of some of the principal literary men of Paris, and Ginguené among the rest; and she also assailed some authors of her own sex—among others, Madame Cottin.

The pen of Madame de Genlis seemed inexhaustible. After the Restoration she wrote in defence of monarchy and of religion; her work, 'Les Dîners du Baron d'Holbach,' which is in a great measure historical, and in which she exposes the weaknesses and the intrigues of the so-called philosophers of the eighteenth century, made a great sensation, and roused the anger of the freethinking party in France. It is a work that contains some curious information. She also wrote 'Dictionnaire Critique et Raisonné des Etiquettes de la Cour,' 2 vols. 8vo., 1818. When she was past eighty years of age she wrote her memoirs. She lived to see the events of July, 1830, and her former pupil raised to the throne. She died on the 31st of December, 1830, aged 84.

Besides the works mentioned above, Madame de Genlis wrote numerous novels, of which those styled 'La Duchesse de la Vallière,' 'Les Battuecas et Zuma,' ou la Decouverte du Quinquina,' are the best. Her works have been published together in 84 volumes, 12mo.

GENNESARET. [PALESTINE.]

GE'NOA, GE'NOVA, a city of Italy, situated on the coast of the Mediterranean, at the foot of the Ligurian Apennines, in the recess of a wide gulf, which extends in the form of a crescent from the frontiers of France to those of Tuscany, and which washes the coasts of the territory of the old Republic. That territory now forms part of the Sardinian monarchy, under the name of Duchy of Genova, and is divided into several administrative provinces,—Genova, Chiavari, Novi, Albenga, San Remo, Savona, and Spezia. The province of Genoa is bounded to the north by that of Novi, east by that of Chiavari, west by that of Savona, and south by the sea, and contains 60 communes and 208,000 inhabitants. It includes the town of Genoa with 94,000 inhabitants within the walls, its extensive suburbs of San Martino with 15,300, and S. Pier d'Arena, 6800; the adjoining valleys of Polcevera and Bisagno; and the maritime towns of Recco, 4000 inhabitants; Nervi, 3300; Pegli, 3000; Sestri di Ponente, 3500; Voltri, 7400; and Arenzano, 2700. The soil is mostly rocky, but the industry of the inhabitants has taken advantage of every spot of cultivated ground. The chief productions are oranges and lemons, light wine, and chesnuts. Maritime trade, fishing, and manufactories constitute the chief resources of the population. The town of Genoa stands partly on the declivity of several hills rising in the form of a semicircle round the spacious harbour, and partly on a narrow strip of ground between them and the sea. It is enclosed on the land-side by a double line of fortifications, the external one being above eight miles in length. The higher Apennines rise immediately behind, dividing the waters which run to the Mediterranean by the valleys of Bisagno and Polcevera, from those which flow northwards into the Scrivia and the Bormida, two affluents of the Po. Upon the summits of these mountains, which are near enough to command Genoa, are several detached forts, called Il Diamante, I Due Fratelli, Sta. Tecla, &c. The appearance of Genoa from the sea is truly magnificent. A succession of fine buildings more than two miles in length lines the shore; numerous palaces and gardens, churches and convents, rise behind like an amphitheatre, on the steep sides of the hills that rear their dark and barren summits above, crowned with formidable ramparts, batteries, and forts; the buildings are square and lofty, and the roofs are covered with light-coloured slate, which has a neat and pleasing effect. The interior of the town is not so pleasant; the streets are very narrow and crooked, dark and steep, with the exception of a few, such as Strada Balbi and Strada Nova, which are entirely lined with marble palaces belonging to the Genoese patricians. Some of these palaces have galleries of paintings, and their internal decorations and furniture are splendid. The palaces Serra, Durazzo, Doria, are among the most remarkable. Genoa has many handsome churches; the cathedral, l'Annunziata, and the elegant church of Carignano, are among the finest. The Loggia de' Banchi, where is the Exchange, the Ponti or quays of the harbour, the Porto Franco or free-port warehouses, where goods can be deposited and re-exported without paying duty; the lighthouse, the new theatre Carlo Felice, built by the late king of that name; the promenade of L'Acquasola, the great hospital, and the former palace of the Doges, are all worthy of notice.

Genoa is a garrison town, the residence of a governor-general, and of a senate or high court of justice for the whole duchy. The French civil and commercial codes have been retained, with some modifications. For public instruction there is the University attended by about 500 students, a Royal college, and six communal schools, one for each district of the town, with very good masters.

The Genoese are shrewd, active, industrious, frugal, and parsimonious. They are well calculated for commerce, which is their real element. The Rivieras or maritime districts furnish the best sailors in the Mediterranean. Genoese vessels trade to the Levant, the Black Sea, the Baltic, to America, and even to the coasts of the Pacific. In 1832 there entered the port of Genoa 2857 vessels, of which 2283 were under the national or Sardinian flag, and of these 427 from the Black Sea, and 648 from beyond the Straits of Gibraltar, including 47 from America. The yearly importations amount to nearly three millions sterling, the exports to somewhat above two millions. The principal articles of export are silk, rice, hemp, oil, and paper. There are at Genoa manufactories of silk stuffs and of woollens, and paper and cotton mills.

The climate of Genoa is healthy, and the atmosphere remarkably pure. Provisions are abundant and at moderate prices. The Genoese speak one of the most difficult Italian dialects, and they have a few books of poetry printed in it.

History of Genoa.—The origin of Genoa, or Genua (its Roman name), is lost in the obscurity of old traditions which would assign to it an antiquity greater than that of Rome. We find it mentioned by Livy (xxi. 32), at the beginning of the Second Punic War, when it appears to have been a town in friendship with Rome. Some years after, Mago, the Carthaginian general, coming with a fleet and army from the Balearic islands to effect a diversion in favour of Hannibal, took Genua by surprise and partly destroyed it. It was restored two or three years after by Lucretius Spurius, after Mago's defeat, agreeably to an order of the Roman senate. (Livy, xxviii. 46; xxx. 1.) From that time Genua appears to have continued in alliance with Rome, but it was not a colony. Strabo (p. 201, Casaub.) mentions Genua as an emporium where the Ligures from the interior brought for sale hides, cattle, honey, and timber for ship-building, and received in exchange oil and wine from other parts of Italy. After the fall of the Western Empire, Genoa was taken possession of by the Langobards, A.D. 641. Charlemagne afterwards took it, and put it, with all maritime Liguria, under the government of a count. After the fall of the Carlovingian dynasty, and during the contests about the crown of Italy between the German emperors and the Berengarii and other claimants, the citizens of Genoa seized the opportunity of asserting their independence under the government of elective magistrates, styled consuls. The names of the consuls began to be recorded from the latter part of the eleventh century. At that time the Genoese had already rendered themselves formidable by sea; after having suffered from the Saracens, who about A.D. 935 surprised and plundered their town, they applied themselves to strengthen their navy, and having allied themselves with the Pisans they drove the Saracens out of Corsica, Capraja, and Sardinia, between the years 1016 and 1021. From that time dates the dominion of Genoa over Corsica and Capraja, and that of Pisa over Sardinia. About A.D. 1088 the united fleets of Pisa and Genoa sailed to the coast of Africa and took Almadia or Mahadia, then an important town between Tunis and Tripoli. They took part in the great Crusade, under Godfrey de Bouillon, and obtained settlements on the coast of Palestine, especially at Acre. In 1146 the Genoese took Minorca from the Moors, and the next year they took by storm Almeria in the kingdom of Granada, where they made an immense booty. The Genoese fleet on this occasion consisted of 63 galleys and 163 transports with 12,000 land forces. In the year after, having joined the Catalonians, they took Tortosa, which was defended by a Moorish garrison. These conquests excited the jealousy of Pisa and Venice, the two other naval powers of Italy; Pisa, being the nearest, was the first to come to blows with Genoa. Four

wars took place between the two states: the first in 1070, which was short; the second in 1118, which was ended in 1132 by the mediation of Pope Innocent II.; the third in 1162, which lasted nearly a century; the fourth in 1282, in which the Pisans were completely defeated by sea near the rocks of Meloria, in sight of their own coast, when 3000 Pisans were killed and 13,000 taken prisoners to Genoa, where most of them died in chains. Pisa never recovered from that blow. In 1290 the Genoese under Conrad Doria destroyed Porto Pisano and filled up the mouth of the harbour.

The rivalry between Genoa and Venice began to show itself soon after the conquest of Constantinople by the Franks in 1244. The Genoese having assisted Michael Palæologus to reconquer his capital, obtained from him the suburbs of Pera and Galata, and the port of Smyrna, with full jurisdiction over those places. The Venetians disputed with them the supremacy of the Levant seas, but after several naval fights the two powers concluded a truce in 1271. After the fall of Pisa the Genoese found themselves more at leisure to renew the conflict with Venice. They put to sea with 165 galleys, each carrying from 250 to 300 men, and sailing up the Adriatic, defeated the Venetians near the island of Curzola, took or burnt 84 galleys, and made 7000 prisoners, including the Admiral Dandolo. Peace was made in 1299, by the terms of which the Genoese excluded the Venetians entirely from the trade of the Black Sea, where the Genoese had formed a succession of colonies, forts, and factories all along the coast. War broke out again in 1346, when the Genoese defeated the Venetians in sight of Constantinople, but were afterwards totally routed on the coast of Sardinia. Genoa, disheartened by this defeat and a prey to internal factions, gave itself up to John Visconti, Duke of Milan. In 1372 war broke out again between Genoa and Venice, for the possession of Tenedos. Genoa had meantime shaken off the yoke of the Visconti. In this, the fourth war between Genoa and Venice, the Genoese took Chioggia and besieged Venice. The Venetians were near capitulating, when Vettor Pisani and Carlo Zeno revived their spirit, formed a new fleet, with which they blockaded the Genoese within Chioggia, and obliged them to surrender. This war, called the war of Chioggia, ended in 1381.

From that time Venice and Genoa remained at peace, with trifling interruptions. Genoa was exhausted by internal factions. To the rule of the consuls had succeeded, about A.D. 1190, that of the Podestà, renewed annually, and who were chosen from among the citizens of another state, in order to avoid the partialities and intrigues resulting from family connexions. This lasted with some interruption till 1270, when two citizens, Oberto Spinola and Oberto Doria, distinguished for their services, usurped the supreme power, under the name of 'captains of liberty,' which they retained till 1291. They reconciled the lower classes to their usurpation by appointing a magistrate called Abate del Popolo, a kind of tribune who supported the rights of the people against the nobles. Foreign captains were next appointed, to be chosen from among the natives of places at least 100 miles distant from Genoa. Afterwards a council was instituted, first of twelve and afterwards of twenty-four members, half nobles and half plebeians. Feuds and fighting often took place within the town between nobles and plebeians, and between Guelphs and Guibelines. Both the Doria and the Spinola were Guibelines, but having quarrelled among themselves they were overcome by the Guelphs, who were headed by the families of Fieschi and Grimaldi, and who exiled their rivals. But the Guibelines of Genoa, unlike those of Florence, were popular among the lower classes, and they re-entered by force. From 1317 to 1331, and again in 1335, these factions continued to desolate the country, so as to render it, says the chronicler Foglietta, a frightful desert. In 1339 the citizens, weary of discord and disorder, instituted a supreme magistrate, called Doge, for life, excluding by law all the nobles, both Guelphs and Guibelines, from ever filling the office. [BOCCANERA; DOGE.] This lasted two centuries, but not without frequent contentions between the principal citizen families, especially the Adorni and Fregosi, who proved just as factious and troublesome as the patricians had been. Several Doges were elected at a time, some were exiled, and others were forced upon the community by an armed faction. The neighbours of Genoa, the Visconti of Milan and the kings of France, taking advantage of these feuds, at various times obtained possession of Genoa. At last, Andrea Doria had the merit of delivering his country from the French yoke; and in order to avoid a recurrence of the former feuds, he changed the institutions of the country, by establishing biennial Doges, and councils to assist and control them. [DORIA.] A roll was made out of all the distinguished families, both noble and plebeian, from among whom the doges, councillors, and other officers of state were to be chosen. This aristocracy however was not wholly closed and exclusive, like that of Venice: new families might be added to it at certain times and with certain qualifications. This form of government lasted from 1528 till Bonaparte's invasion of Italy, when the democratic party, assisted by the French, rose upon the aristocracy, who were supported by the lower classes, and a scene of bloodshed took place which lasted several days, and ended in the discomfiture of the democrats. But the French Directory now took up their part openly, pretending that the honour of the French republic was concerned, and demanded a complete change in the institutions of the country. A democracy was formed, protected by a strong French garrison within the town. In 1799 the French, under Massena, were besieged within Genoa by the Austrians and the English, and after a most gallant defence the town capitulated to the Austrians, but was again given up to the French after the battle of Marengo. Bonaparte, then consul, gave a new form of government to Genoa, leaving to it a sort of nominal independence and the name of republic, but, in fact, he made it less democratic than before. Napoleon, when emperor, in 1805 required the formal annexation of Genoa to France. The Doge Durazzo repaired to Milan, where Napoleon had just been crowned king of Italy, and stated 'the wishes of the Genoese senate and people to be united to the Great Empire.' These wishes were immediately granted. The state of Genoa was formed into the three French departments of Genoa, Montenotte, and the Apennines. In 1814 Genoa surrendered to the English forces under Lord William Bentinck, and in the following year, by a decision of the Congress of Vienna, it was united to the Sardinian monarchy.

Of all her foreign possessions Genoa retained Corsica the longest; till 1768, when she ceded it to France. Her numerous and wealthy settlements in the Levant and the Black Sea she lost after the Ottoman conquest of the Eastern Empire. In the 18th century her navy was reduced to a few galleys, and her flag was insulted with impunity by the Barbary privateers. Since the last peace the spirit of commercial enterprise in her citizens has been greatly revived. The Sardinian navy is chiefly manned by Genoese. (Foglietta, Caffaro, and the other old Genoese chroniclers; Botta, *Storia d'Italia*; Serra, *Istoria dei Liguri e dei Genovesi*.)

GENOVE'SI, ANTO'NIO, born near Salerno in 1712, was ordained priest in 1736, and was made professor of eloquence in the clerical seminary of Salerno. He afterwards repaired to Naples, where he was allowed, through the influence of Monsignor Galiani, archbishop of Taranto, to open a class of metaphysics in that university in 1741. He here then wrote his 'Elements of Metaphysics' in Latin, which he afterwards recast into two Italian works, 'Logica per i giovanetti,' and 'Delle Scienze Metafisiche,' which had great success, and are still much esteemed. His 'Logica' is perhaps the best elementary book of that science in the Italian language. His 'Meditazioni filosofiche sulla Religione e sulla Morale,' are replete with sound judgment, though written in a defective style. In his 'Diceosina, o la Filosofia dell' Onesto e del Giusto,' he proceeds on the principle that 'every thesis in morality is susceptible of logical demonstration.' These are the principal works of Genovesi on the moral sciences. We must now consider him as a political economist. In 1754 Bartolommeo Intieri, a wealthy Florentine merchant, settled at Naples, founded a chair 'of commerce and mechanics,' and with the approbation of the king appointed Genovesi to fill it. This was the first chair of political economy, taken as a distinct science, established in Europe. In the course of his professorship Genovesi wrote his 'Lezioni di Commercio, o di Economia civile,' 2 vols. 8vo. His book is full of sound principles, which were quite new at Naples in his time, although in some instances he still adhered to the Colbert school. His lectures excited a prodigious sensation among the Neapolitans; public attention was at once turned to questions of commerce, arts, and

agriculture; and political economy, the very name of which was hitherto unknown, became quite a fashionable study.

When in 1767 the Jesuits were exiled from the kingdom, the minister Tanucci consulted Genovesi as to a new plan for the organization of the schools and colleges of the kingdom, which he drew up accordingly. He continued to lecture and to write, although his health was greatly impaired for several years, almost to the day of his death, which occurred in September, 1769. The mind of Genovesi is exhibited in the following lines, which he wrote to his friend Angelo Pavesi in 1765: 'I am now getting old, and have nothing more to hope or to expect from this world; but my wish would be to leave my countrymen a little more enlightened than I found them, and also a little more affectionate towards virtue, which is the only true source of good. It is of little use to think about government, arts, or commerce, unless the morals of a nation are also reformed. As long as men will find their interest in being rogues, we must not expect much from our methodic labours.' A selection of Genovesi's familiar letters was published after his death, in two small volumes. He edited in his lifetime the 'Course of Agriculture' of Cosimo Trinci, to which he added notes and a preliminary disco[urse] on the state of Neapolitan agriculture in his time. [Ga]lanti, one of Genovesi's best disciples, wrote an 'Elogio Storico,' or biographical notice of his master, and Fabbroni wrote another in Latin. Ugoni, in his *Letteratura Italiana*, devotes a long article to Genovesi.

GENSERIC, king of the Vandals, was the bastard brother of Gonderic, whom he succeeded A.D. 429. In the same year he left Spain, which had been partly conquered by the Vandals, and crossed over into Africa at the solicitation of Boniface, governor of that province, who had been induced, by the arts of his rival Aetius, to rebel against Valentinian III., emperor of the West. Boniface soon repented of the step he had taken, and advanced to meet the invader. But his repentance came too late. The Moors joined the standard of Genseric, and the powerful sect of the Donatists, who had been cruelly persecuted by the Catholics, assisted him against their oppressors. Boniface was defeated, and obliged to retire into Hippo Regius, where he remained till he obtained a fresh supply of troops. Having ventured upon a second battle, and being again defeated, he abandoned the province to the barbarians, and sailed away to Italy. A peace was concluded between Genseric and the emperor of the West, by which all Africa, to the west of Carthage, was ceded to the Vandals. This however did not long continue; and the city of Carthage was taken by the Vandals by surprise A.D. 439. The emperors of the West and East made great preparations for the recovery of the province; but an alliance which Genseric formed with Attila, king of the Huns, effectually secured him against their attempts.

Genseric's next object was directed to the formation of a naval power; an immense number of ships was built, and his fleets ravaged the shores of Sicily and Italy. Invited by the empress Eudoxia, he sailed up the Tiber (A.D. 455), and permitted his soldiers, for the space of fourteen days, to pillage Rome. In A.D. 460 he destroyed the fleet which the Emperor Majorian had collected for the invasion of Africa; and as his power increased his ravages became more extensive; the island of Sardinia was conquered, and Spain, Italy, Sicily, Greece, Egypt, and Asia Minor, were plundered every year by the Vandal pirates. Leon, the emperor of Constantinople, at last resolved to make a vigorous effort for the recovery of Africa. A great army was assembled, and the command was given to Basilicus. He landed at Bona, and at first met with considerable success, but was at length obliged to retire from the province. After this victory Genseric met with no further opposition, but remained undisturbed master of the sea till his death, which happened A.D. 477. He was succeeded by his son Hunneric. Genseric was an Arian, and is said to have persecuted the Catholics with great cruelty. (Procopius, *De Bell. Vandal.*; Gibbon's *Decline and Fall*, c. xxxiii.—xxxvi.)

GENTIA'NA, a genus of herbaceous plants, giving their name to the natural order Gentianaceæ, remarkable, as ornamental objects, for the brilliant colours and beautiful forms of their flowers, and most useful in medicine, on account of the pure intense bitter which they all contain. The species are extremely numerous, inhabiting the temperate parts of Europe, Asia, and America, chiefly in mountainous situations, where they breathe a pure and rarified air, are exposed to bright light during the short summers of such regions, and although fixed during winter in places intensely cold, yet are so well prepared to resist it by the warmth of their summer, and so much protected by the snow that covers them, as to suffer no injury. These alpine plants are consequently difficult to cultivate, or even uncultivable, from the impossibility of imitating their natural atmosphere; and hence it is only a very small number that are ever seen in gardens. The prevailing colours of their flowers are either an intense pure blue, or a bright clear yellow: some idea may be formed of the brilliancy of the former from that of Gentiana acaulis, a common species in gardens, where it is much employed for making edging to borders; the yellow species are equally represented by Gentiana lutea, a tall kind, which thrives well in a common American border. As the various plants comprehended in the genus Gentiana, as defined by Linnæus, are extremely different in appearance, and offer great diversities of structure in their flowers, some attempts have been made to break the Linnæan genus up into several others. Botanists however have not received these innovations favourably, and therefore, although Dr. Grisebach's new arrangement will probably be adopted, we shall still consider the species as all belonging to one and the same genus.

The ornamental species that are found easily capable of cultivation are G. lutea, with yellow, and G. asclepiadea, saponaria, cruciata, septemfida, acaulis, and Pneumonanthe, with blue flowers. Of these all require a good American border of peat-earth to grow in, with the exception of G. acaulis, which prefers the hardest and stiffest clay. Many other species are named in gardening books, but they generally perish as soon as they are brought under the hands of the cultivator. For medical purposes, the root of Gentiana lutea, a native of the central parts of Europe, is principally collected, especially for the French and English markets; but Gentiana purpurea and punctata have roots that are still more bitter, and the latter is said to furnish the chief part of what is consumed in Germany and the north of Europe. In the Himalayas the roots of Gentiana Kurroo are used as a substitute, and the stems and leaves of G. cheretta.

GENTIA'NA LUTEA, a perennial species, common in the mountainous and sub-alpine districts of Switzerland, Germany, &c. Though the whole plant is bitter, yet as this property is most concentrated in the root, that part only is officinal. This should be taken up in autumn, and is best when the plant is only one year old. It is generally cylindrical, often an inch thick at the summit, but below rather branched, of a dark or brown colour externally; internally fleshy and yellow. In commerce it is met with in pieces, cut longitudinally, from a half to one foot in length. A transverse section displays three distinct circles. The greater portion is procured from Germany; the specimens from Switzerland are generally thicker and darker coloured.

When fresh it has some smell, which is almost entirely lost by drying. The taste is at first somewhat sweet, then purely and strongly bitter. According to the analysis of Henry and Caventou, it contains a principle termed Gentianin, which is crystallizable; a volatile odorous principle, a greenish fixed oil, a free organic acid, uncrystallizable sugar, gum, colouring matter, &c.

Owing to its saccharine matter it soon moulds in a damp place, and should therefore be kept in a dry airy situation. From the abundance of the sugar, it is easily susceptible of fermentation, and from it is distilled a spirit, called Enziangeist, or 'bitter snaps,' much employed by the peasants on the Swiss Alps to fortify the system against the fogs and damps of these lofty regions.

Yellow gentian-root is often confounded with the roots of other species of this genus, a circumstance attended with no bad consequences, but unfortunately roots of very poisonous plants, growing in the same locality, are often taken up instead of the proper one: these are, the Veratrum album (white hellebore), the leaves of which resemble those of gentian in their peculiar venation, but are alternate, while those of gentian are opposite—the root is very different, and besides this, it contains Veratria; and the Atropa Belladonna (deadly night-shade), which, besides differences in the physical characters, is devoid of the peculiar bitter of gentian, and acquires a bluish-black colour from tincture of iodine. The roots of Aconitum Lycoctonum and Ranunculus Thora are occasionally confounded with gentian-root.

Gentian-root is a pure and excellent bitter tonic, useful in all cases of debility, whether of the stomach only, or of

the system generally. It possesses facilities, from not being decomposed, of being administered along with many metallic salts. It yields its properties to water, particularly when warm, to alcohol, and to wine. The simple infusion, and not the compound, of the 'London Pharmacopœia' should be employed, when any salts of iron are prescribed in the same formula. The extract is an eligible means of giving bulk, when several antispasmodic remedies, of which the dose is minute, are to be made into pills, such as oxide of zinc, protosulphate of iron, or extract of aconite. In the West Indies a preparation of gentian is used daily before meals, to give tone to the languid stomach.

In the East Indies several species are used as bitter tonics. The Chirayita, or Chiretta, in the form of a cold infusion, is much prized for its tonic and febrifugal virtues. Guibourt contends that this plant is the Calamus aromaticus of the antients, an opinion from which Dr. Royle dissents. ('Flora of the Himalaya,' p. 277.)

GENTIANA'CEÆ, an extensive order of monopetalous Exogens, consisting of herbaceous plants, with opposite ribbed leaves, and flowers whose corolla is imbricated, the stamens alternate with the petals, the ovary superior, with two cells standing right and left of the axis of growth, and seeds containing a minute embryo lying in a mass of albumen. They are generally considered to be in the closest alliance with Scrophulariaceæ, but it is possible that their resemblance to that order is one of analogy rather than affinity. Along with Orobanchaceæ and Monotropaceæ, they seem rather to belong to the albuminous group of Exogens, as has already been shown. [EXOGENS.] The flowers of these plants are usually coloured with pure bright yellow, red, or blue, and in many cases they are on this account among the most beautiful of flowers; but if we have a high development of form and colour in the majority of the species of this order, so we also have in the Guayana and Mexican plants belonging to the genus Voyra or Leiphaimos, the brown leafless habit and low development of Orobanche. This order is famous for its bitterness, which seems to pervade all the species. Gentiana itself furnishes all the officinal kinds; but Erythræa Centaurium, a beautiful wild flower, common in many parts of England, is advantageously employed by country-people as a substitute;

2 3 1

Gentiana lutea.

1, a capsule; 2, the same cut across, to show the placentæ; 3, a vertical section of a magnified seed.

and the root of Frazera Walteri has been used as a means of adulterating the bitter Calumba root.

GENTLEMAN, a corruption of *gentilhomme*, our Saxon ancestors having very early substituted 'mon,' or 'man,' for the corresponding term of the Norman-French, from which they originally received the term. Some form of this word (a compound of *gentilis* and *homo*) is found in all the Romance languages (*gentil-homme* in French, *gentil-uomo* in Italian, and *gentil-hombre* in Spanish), and it is undoubtedly one of the many traces of the great influence which the laws and polity of Rome have exercised upon modern society and civilization.

In the earliest form of the Roman constitution the populus, or ruling portion of the community, was divided into gentes, who were united by a common name, and the performance of certain sacred rights. Each gens was again subdivided into several familiæ, distinguished by a surname in addition to the common gentile appellation. Thus the gens Cornelia comprised the families of the Scipiones, the Lentuli, the Syllæ, &c. Now, in default of the Agnati, or of heirs in the male line, the property of the family reverted, not to the whole populus, in whom, of strict right, the sovereignty lay, but to the gens to whom it had transferred its rights.

This right of reversionary succession, especially in the case of usufructuary possessions of the public lands, being the most valuable and important privilege of the patricians, was brought prominently forward in the quarrels between the nobles and the plebeians, and the phrase *gentem habere* (Livy, x. 8) is often employed as distinctive of the former. Afterwards, when the members of the plebs obtained the right of intermarriage with patrician families, and an access to the honours of the state, which conferred the *jus imaginum*, or nobility, they also received the rights and privilege of *gentes*. To be admitted into a *gens*, became henceforward equivalent to a patent of nobility in modern times, and *gentilis* is accordingly widely defined by Cicero (*Top.* 6), as denoting those who were of the same name and stock, free-born, in the full enjoyment of all the rights of citizenship, and whose ancestors were always free. Hence also, in an opposite sense, '*sine gente*' is employed by Horace (*Sat.* ii. v. 15) and Suetonius (*Tib.* 1) for ignobly born and of servile parentage.

This privilege of succession, which was called *jus gentilitatis*, or simply *gentilitas* (Cic., *De Oratore*, i. 38), and formed one of the enactments of the Twelve Tables, was gradually undermined by the encroachments of the prætors on the civil law, and finally disappeared (Gaius, iii. 25); but the name has survived in all the languages of Western Europe.

According to Selden (*Titles of Honour*, p. 852), 'a gentleman is one that either, from the blood of his ancestors, or the favour of his soveraigne, or of those that have the vertue of soveraigntie in them, or from his own vertue, employment, or otherwise, according to the customes of honour in his countrie, is ennobled, made gentile, or so raised to an eminencie above the multitude, that by those lawes and customes he be truly nobilis, or noble, whether he have any title, or not, fixed besides on him.' That the word was formerly employed in this extensive signification is clear, from a patent of Richard II., by which one John de Kingston is received into the estate of a gentleman and created an esquire ('Nous lui avons resceivez en l'estate de gentilhome et lui fait esquier); and from another of Henry VI., who there, by the term 'nobilitamus,' creates one Bernard Angevin, a Bourdelois, a gentleman. And, according to Smith (*De Rep. Ang.*, lib. i. c. 20, 21), under the denomination of gentleman are comprised all above yeomen, whereby noblemen are truly called gentlemen.

In a narrower sense a gentleman is generally defined to be 'one who, without any title, bears a coat of arms, or whose ancestors have been freemen; and by the coat that a gentleman giveth, he is known to be, or not, descended from those of his name that lived many hundred years since.' (Jacobs' *Law Dictionary*.) There is also said to be a gentleman by office and in reputation, as well as those that are born such (2 *Inst.* 668); and according to Blackstone, quoting Sir Thomas Smith (1 *Comm.*, p. 406), 'Whosoever studieth the laws of the realm, who studieth in the universities, who professeth the liberal sciences, and (to be short) who can live idly and without manual labour, and well bear the port, charge and countenance of a gentleman, he shall be called master, and taken for a gentleman.'

The learned author must have been somewhat puzzled with his definition of a gentleman, as understood in his time. Having defined a gentleman to be one who studieth the laws, &c., he adds (to be short), that he who can live idly and bear the port, &c. of a gentleman, is a gentleman; that is, if he can live idly, and if he can also do as a gentleman does (it not being said what this is), he is a gentleman. Perhaps a definition of the term, as now used, would not be easily made; it being extended by the courtesy of modern manners to many who do not come within the antient acceptation of the term, and denied by public opinion to many whose rank and wealth do not make up for the want of other qualifications.

GENTOOS. [HINDUSTAN.]

GENUS, in physics, signifies a multitude or class of objects possessing some common quality or qualities: in logic it denotes the material part of the definition.

When we direct our attention to a particular object, we discover under its apparent unity a great variety of characters and qualities; and, upon an examination of several objects, we observe many points of agreement and difference between them. By the power which we possess of concentrating our faculties, we are enabled to consider these mutual relations and resemblances without any regard to their differences: we as it were draw the one away from the other; in short, we abstract them.

Now by abstraction we may either confine our view to a quality inherent in some object independently of that object; or else, neglecting the many points of disagreement which exist between a number of objects, we may seize upon the qualities that belong to all in common, in order to combine them into a single idea. In the former case the notion is simply abstract; in the latter it is abstract and general: and the multitude of objects to which we apply the general notion or common term constitutes a *genus*.

In this operation we may proceed continually by neglecting in succession a greater number of differences, and comprising under the common denomination fewer points of agreement and resemblance. In this manner we form a series of notions or genera of higher and lower order, until we ultimately arrive at the highest possible—that of *being*. In this co-ordination of genera, every intermediate genus is called a subaltern genus or species, being such in respect of different other terms; for that of which a higher genus is predicated is called a species, while relatively to all lower species it is itself a genus. Lastly, that which is not contained under any higher, is called the *summum genus*, and that under which individuals only are comprised is usually called the *infima species*.

These general notions and genera are the principles of classification and arrangement, and without them the knowledge of facts and nature itself would be, if not absolutely impossible, at best a confused mass of conceptions and objects without beauty, order, or coherence. But at the same time that we thus admit the utility of such general notions, we must remember that they are purely relative to human science and its objects; that even as such they are imperfect, and very far from conveying an adequate expression of the truth of nature, wherein there is nothing really corresponding to them, but only a something in the individual objects from which we derive them, which not only is the cause and the occasion of our forming them, but also transferring to them, as it were, a part of its own verity and existence, justifies us in according to them our confidence in science and action.

GEOBDELLA. (Zoology.) [LEECH.]

GEOCENTRIC (having the earth as centre), a term applied to the place of a planet, as seen from the centre of the earth, in opposition to its *heliocentric* place, as seen from the centre of the sun. [PARALLAX.]

GEOCICHLA, a genus of birds established by Mr. Gould for a pretty species resembling the Redbreast (*Erithacus Rubecula*, Swainson). It belongs, he observes, to an interesting group which was first characterized by M. Kuhl, and of which the Society's collection possesses four well-marked species. (*Zool. Proc.* 1836.)

GEOCOCHLIDES, Latreille's name for the shell-snails: *Trachélipodes colimacés* of Lamarck; *Limacinés* of De Blainville; *Limaçons* of De Férussac.

GEO'DESY is that branch of applied mathematics which determines the figures and areas of large portions of the earth's surface, the general figure of the earth, and the variations of the intensity of gravity in different regions, by means of direct observation and measurement.

Some of the antient philosophers, who lived several centuries before the Christian æra, were acquainted with the nearly spherical form of the globe, and even devised methods for measuring approximately a meridional circumference [ERATOSTHENES]. The Arabs long afterwards pursued the same object, and the Caliph Almamoun, in A.D. 814, ordered the measurement of a degree in the plains of Mesopotamia, an example which, after another long interval, was imitated by Snellius in Holland, Norwood in England, and by several French and Spanish mathematicians. Richer observed a variation in the length of the seconds' pendulum when sent to Cayenne by the French academy of sciences, the true cause of which phænomenon was explained by Newton; for the centrifugal force arising from the earth's rotation round its axis in twenty-four hours is directly opposed to the force of gravity at the equator, and in other latitudes the part of this force which acts in the direction of the plumb-line is nearly proportional to the square of the cosine of the latitude. He has also proved in his 'Principia' that a uniform fluid spheroid, in which the ratio of the centrifugal force to the attraction at the surface was the same as in the earth, would be in equilibrium when the axis of revolution was less than the equatorial diameter by 1-230th of the latter. From that time measurements have been undertaken under the directions of the various governments of Europe, to determine if the globe were really flattened at the poles, and also for the purpose of forming exact maps with respect to the latitude, longitude, and altitude above the level of the sea, of places in their respective dominions; and lastly, the French have deduced their legal metre of length from the measurement of a particular meridian arc. Jacobi has lately shown that a revolving fluid ellipsoid, having three unequal axes, may also present a surface of equilibrium.

The result of so many geodetic enterprises has not been as successful as could be wished. Some of the earliest attempts by the French were faulty in computation, and gave results directly contrary to Newton's theory, and some able mathematicians of that day appear to have been misled by a feeling akin to envy, to the extent of supporting these false conclusions by plausible reasonings. The error of that survey has been since discovered, and all the methods which have been employed in the numerous trials undertaken in this and the last century agree in proving that the polar axis of the earth is shorter than the equatorial by about 1-300th; but they have served at the same time to demonstrate that the earth is not a spheroid, that it is not a solid of revolution, and that the figures of the northern and southern hemispheres are dissimilar. Hence if we suppose a solid of revolution having its axis in the same direction as that of the earth, and osculating the surface of the latter, the excentricity of this spheroid varies both with the latitude and the longitude of the place.

If the materials which compose the solid mass of the earth had equal capacities for heat and became liquid at equal temperatures, the spheroid of revolution would most probably be the figure assumed at the epoch when the cooling of the whole had rendered it solid. Such however is not the case; a great portion of the surface of the globe is yet liquid, and of the solid parts some must have assumed that state prior to others. It is also possible that the temperature of space is variable within the extent of the solar system, and therefore the conditions for the cooling of the northern and southern hemispheres may be different, and a very small difference would suffice to produce, in a long series of ages, a marked difference between the temperatures of the two hemispheres, and therefore a corresponding difference would arise relative to their forms. The general sphericity of the earth cannot be otherwise conceived than by its primitive fluidity, and the irregular cooling of its parts accounts sufficiently for the observed departures from the spheroidical shape, which would have been otherwise produced by the attraction of its parts and the centrifugal force of rotation. The other bodies of the solar system which have short periods of rotation present the analogous appearance of unequal axes, the equatorial axis being always the longer.

In the trigonometrical survey of portions of the earth's surface, the extent or area may be computed more and more approximately by the suppositions of such portions being plane, spherical, spheroidical, and lastly of being

coincident with the osculating spheroid. We shall now explain the manner in which geodetic measurements are conducted, and the various corrections and reductions which it is necessary to apply to the principal calculations.

In order to measure an arc of the meridian, a series of stations are chosen near it in the most advantageous positions which the locality will permit; the lines which successively connect those stations form a series of triangles, in each of which, if one side and two angles, or two sides and one angle, are known, the remaining sides and angles are determinable by trigonometry; and if one extended line connected with the triangles, and called a base of verification, be measured, it serves at the different stages of the operation to detect any small errors which may have crept into the calculations. The stations should be so chosen that the triangles should be as nearly equilateral as possible, for then the errors of observation in the angles have the least influence in producing corresponding errors in the sides opposed to them. The measurement of the angles is effected by a theodolite, to which one or more telescopes are attached, with circles or arcs accurately graduated and accompanied by a vernier. The French, in the great survey between Dunkerque and Barcelona, which was conducted by Delambre and Mechain, employed Borda's repeating circle; while, in the English and Irish survey, a zenith sector, constructed by Ramsden expressly for this purpose, was used. It is of great importance that the telescopes should have a motion in azimuth as well as a vertical motion. In a Memoir on the Doctrine of Chances applied to geodetic operations ('Connaissance des Tems,' 1820, p. 422), Laplace shows that it is in general an advantage to have the series composed of as few triangles as possible, and yet in the surveys we have mentioned a great number were employed without producing on an extended base any considerable error. When a country is deficient in spires, towers, or other lofty edifices, situated conveniently for stations, artificial ones are easily raised, and if illuminated at the top and provided with parabolic reflectors directed towards the observer, these, when employed by night, are found eminently successful. Care must however be taken that this station be estimated at the foot of the vertical passing through the object observed, and corrections must be applied for any eccentricity in the position of the telescope, or error in its line of collimation. The angles observed not being in the horizon, must be reduced to it by a formula given in most treatises on spherical trigonometry. (Woodhouse's *Trigon.*, Appendix.) M. Delambre again reduced the latter angles to the angles between the chords of the spherical area between the stations, and therefore his series corresponded to the edges and faces of an inscribed polyhedron. (*Base du Système Métrique.*)

The three angles of any triangle in the series when added together are always greater than two right angles, which is a known property of every spherical triangle; but M. Legendre has shown that they may be treated as plane triangles by taking from each angle the third part of the excess of the sum above two right angles—a theorem of great use in geodesy, and which, as the same mathematician has proved, may be extended to spheroidical or other triangular portions of curved surfaces.

It happens not unfrequently that the instrument cannot be placed at the very centre of the station which forms the true angular point of the particular triangle in the series; by placing it as near to the centre as the observer conveniently can, a small correction, which is easily calculated, will reduce the observed angles to those which would have been observed had the centre been the point of observation: this correction is called *the reduction to the centre*. (Delambre, *Déterm. d'un Arc du Mérid.*, p. 24.) A similar correction must be applied when the observed object is a tower with a polygonal base. Another source of error is the oblique illumination of the observed object, which it is most important to correct, many of the surveys of the last century being faulty by the observer either disregarding or being ignorant of the change of apparent position which is thus produced.

The actual measurement of the bases is one of the most delicate operation in geodesy, and requires the greatest precaution; it is best that they should be as long as possible and chosen on level ground, or at least that they may be in vertical planes, so as to correspond to arcs of a great circle when the earth is regarded as spherical. But the great difficulty is to determine their lengths in reference to a fixed unit of length; for whatever material may be employed for the chain or rod of measurement, the variations of temperature will produce sensible alterations in their length. These indications must be reduced to a fixed state of the thermometer, and if they are of a nature to be affected by moisture, it will be necessary also to make a correction for the hygrometric state of the atmosphere. The French employed for rods a species of metallic thermometer consisting of a copper rod placed on one of platinum, which had precisely the same length at a known temperature; as these metals expanded unequally by heat, the difference easily indicated the proper correction: the English in the late survey first employed glass at Hounslow-heath, and afterwards also steel rods, and applied the correction for temperature, which was small in the former case. The following table gives the proper corrections for the materials generally used; it must be however remembered that the linear dilatation is not always the same in the three dimensions of a body:—

Names of Substances.	Linear Dilatation.	
Copper	·00001,72244	For one degree of Cent. therm.
Brass	·00001,86671	
Soft iron, wrought .	·00001,22045	
Glass tube, without lead	·00000,87572	
Platina	·00000,85655	

Sometimes it is impracticable to have a base coincident with a single geodetic line, as was the case in the instances of the bases at Melun and Perpignan; when accurately measured they are to be projected on a horizontal plane by multiplying them by the cosine of their inclination to the horizon, which being a very small angle, it suffices to subtract a small quantity proportional to the square of this angle.

$$(\text{Cos. } \theta = 1 - \frac{\theta^2}{2} \text{ when } \theta \text{ is small.})$$

General Roy in 1784 measured a base of five miles on Hounslow-heath, reducing his observations to the level of the sea and a temperature of 62° Fahrenheit, and formed a series of triangles between Greenwich and Dover. After his death (1790), Colonel Mudge extended it to Dunnose in the Isle of Wight: a verification-base being measured on Salisbury Plain; and the same great survey has been extended to Ireland and Scotland under Lieutenant-Colonel Colby, by whom a base of seven miles was measured near Londonderry.

The irregular figure of the earth is the cause that the geodetic meridian is not a plane curve. If through a point on the earth's surface and the axis of the earth a plane be drawn, this plane intersects the celestial sphere in a great circle, which is the celestial meridian of the place. Conceive verticals to be drawn parallel to this plane; the points where these verticals meet the irregular surface of the earth have evidently a common celestial meridian, and since the radius of this circle is indefinitely great, the locus of all these points forms a *geodetic line*. If another section of the surface be taken perpendicular to this, the radii of curvature of these two curves at their common intersection are sufficient to give that of any other section made through the same point by a plane of known inclination to either, whatever be the figure of the earth's surface, and the sum of the curvatures of any two rectangular sections through the same point is constant. The geodetic line possesses the singular property of being the shortest route between any two points taken in it; the equations to this curve of double curvature may therefore be found either by the differential calculus, if we consider the points of which it is the locus, or by the calculus of variations, if we regard the above-mentioned property. When the surface is one of revolution, this line is in the plane of the celestial meridian of the place, and is the same as the curve of revolution; but as it is not a plane curve, it follows that the earth is not a solid of this nature.

The refraction of light by the atmosphere is very great when the visual ray is nearly horizontal; and hence arise great errors in the measurement of angles, whether the observed objects are in the same level or not. These errors are generally remedied by an empirical law for terrestrial refraction, but all such laws fail to apply in the varied states of rarefection or of moisture in which the lower strata of the atmosphere are found; the best remedy is to seize the most propitious opportunities, when the heat of the surface of the earth has undergone no sudden changes, and when the atmosphere is fair and free from fogs.

All the preceding corrections being made so as to ensure the accuracy of the observations, it is necessary to reduce all to one level: for this level the mean surface of the sea, between its ebb and tide, or that which would be its level if there were no tide, is selected. The barometer must then be used to determine the altitude of the place of observation above this level, and a formula given by Laplace, and inserted in most treatises on hydrostatics, being applied, will give the altitude of the place, which with its latitude and longitude are all the co-ordinates necessary to determine its position. The preceding remarks are probably sufficient to give an idea of all the difficulties and delicate processes necessary for an exact trigonometrical survey.

The results of the most careful geodetic measurements show that the earth is compressed at the poles and extended at the equator. The lengths of a degree diminish regularly in the following different countries, to which we have annexed the names of the surveyors: Sweden, Melanderhielm; England, Mudge; Cape of Good Hope, Lacaille; France, Delambre; Italy, Boscovich; Pennsylvania, Mason; Peru, Bouguer; India, Lambton: but in distances which are small compared with the surface of the earth, the alteration in the length of the degrees is very irregular, as is strikingly manifested by the English base of General Roy, connected with the French of Delambre prolonged by Biot and Arago.

Another method has been adopted to determine the ellipticity of the earth by means of a seconds' pendulum, which, as well as direct measurement, indicates the flattening of the earth towards the poles. The following table is taken from the 'Mécanique Céleste,' tom. ii. No. 42; the latitudes are expressed in grades, and the length of the pendulum at Paris is adopted as the unit; the seconds are centesimal and of mean time:—

Place of Observation.	Latitude.	Length of Pendulum.	Name of Observator.
Equator	0·00	0·99669	Bouguer.
Porto Bello	10·61	0·99689	Id.
Pondichéry	13·25	0·99710	Le Gentil.
Jamaica	20·00	0·99745	Campbell.
Cape of Good Hope	37·69	0·99877	La Caille.
Toulouse	48·44	0·99950	Darquier.
Vienna	53·57	0·99987	Liesganig.
Paris	54·26	1·00000	Bouguer.
Gotha	56·63	1·00006	Zach.
London	57·22	1·00018	. . .
Arengsberg	64·72	1·00074	Grisschow.
Petersburg	66·60	1·00101	Mallet.
Lapland	74·22	1·00137	Academicians.

By employing the method of least squares, and assuming the figure of the earth to be nearly spheroidical, Mathieu has deduced from these observations $\frac{1}{315}$ as the fraction which expresses the eccentricity; the theory of the lunar inequalities make it to be $\frac{1}{\ }$, which differs but little from the former, and still less from that which corresponds to the southern hemisphere; the English observations would give $\frac{1}{290}$.

In the 'Philosophical Transactions' from the year 1819 to 1830, may be found the experiments on the length of the pendulum by Captains Kater, Sabine, Foster, and Mr. Fallows; an account of which, together with those of Freycinet and Duperrey, is inserted in the 7th volume of the 'Memoirs of the Royal Astronomical Society,' by Mr. Baily. Besides the works already quoted, the reader may consult with advantage the article on the Figure of the Earth, by Mr. Airy, in the 'Encyclopædia Metropolitana,' and the 'Traité de Geodésie,' by Puissant.

GEOEMY'DA. [TORTOISES.]

GEOFFRÆA INERMIS, or **ANDI'RA INERMIS**, is a tree inhabiting the tropical parts of America, and yielding a bark, with emetic, drastic, purgative, and narcotic properties, and in large doses poisonous. It acts as a powerful anthelmintic. The leaves are pinnate, and covered with a rusty down; the leaflets are oblong-lanceolate, or ovate-lanceolate, acuminate, and the flowers are arranged in terminal and axillary ferruginous panicles, very showy, with reddish lilac petals. Legume the size of a large plum. An account of it by Dr. Wright will be found in the *Philosophical Transactions* for 1777, p. 512, t. 70.

GEOFFREY OF MONMOUTH, otherwise named **ARTHUR**, the well-known British historian, was born in the town from which he took his name, and is supposed to have received his education at the Benedictine monastery in its vicinity. Tradition still points out a small apartment in the remains of that monastery which is designated as his study. He was made archdeacon of Monmouth, and on the 24th February, 1152, consecrated bishop of St. Asaph. Robert, earl of Gloucester, natural son of Henry I., and Alexander, bishop of Lincoln, were his chief patrons.

Walter Mapes, at that time archdeacon of Oxford, a diligent inquirer for his day after the works of antient authors, is said, whilst journeying in Armorica, to have met with a history of Britain written in the British tongue, the translation of which, upon his return to England, he recommended to Geoffrey of Monmouth, who undertook the task and completed it with great fidelity. At first he divided it into four, but afterwards into eight books, to which he added the book of Merlin's 'Prophecies,' which he had also translated from British verse into Latin prose. Numerous fabulous and trifling stories are inserted in the history, to an extent which has induced some authors, and among them Buchanan, to consider the whole as fiction; but others, among whom are Archbishop Usher, Leland, &c., consider that parts of his history are true, and that the work is not to be rejected in the gross. The best Welsh critics seem to consider that Geoffrey's work was a vitiated translation of the 'History of the British Kings,' written by Tyssilio or St. Talian, bishop of St. Asaph, who lived in the seventh century. Geoffrey's omissions, additions, and interpolations are very numerous; and his Latin for British appellations frequently very difficult to understand.

Several editions of Geoffrey's history are extant in Latin; the earliest is in 4to., printed by Ascensius at Paris in 1508; reprinted, 4to., 1517. It was also printed by Commeline at Heidelberg, in folio, 1587, among the 'Rerum Britannicarum Scriptores vetustiores et præcipui.' A translation of it into English, by Aaron Thompson, of Queen's College, Oxford, was published in London, 1718, in 8vo. (Tanner, *Bibl. Britan. Hib.*, pp. 305, 306; Nicholson's *Hist. Library*; Chalmers's *Biog. Dict.*, vol. xviii., p. 488-492.)

Copies of Geoffrey of Monmouth's history, in manuscript, are not unfrequent in our great libraries: several, of an age very near his time, are preserved among the manuscripts of the Old Royal Library in the British Museum; one formerly belonging to the library of Margan Abbey is believed to be the best. Geoffrey of Monmouth died about the year 1154.

GEOGRAPHY (a term derived from the Greek *γεωγραφία, geographia*) is a science the general object of which is to describe the surface of our globe. Its more special object is to ascertain and describe such physical peculiarities in each country as tend to promote or retard the increase of population and the arts of civilized life.

The political condition of a nation and the changes to which it is subject are in a great degree dependent on the character of the country which it inhabits, or of those countries which surround it. The difference in civilization observed in nations living near one another may also in a great degree be ascribed to the same cause. Accordingly we find that as soon as men began to apply themselves to the explanation of such changes and differences, they were obliged to look to the particular character of the countries inhabited by those nations whose history it was their object to investigate. Geography is coeval with history. It is as impossible to form a just idea of the events which have been most decisive in the history of a nation without a knowledge of their country, as it is to understand the movements of two armies on a field of battle without knowing the nature of the ground which is the scene of their operations.

Herodotus, the father of history, is likewise the father of geography. His geographical descriptions are short and general, but always clear and sufficient to show how far the physical peculiarities of each country influenced the changes and events which he had undertaken to commemorate. When he found that a country was characterized by striking peculiarities he described them at considerable length. An instance of this is his description of Egypt in the second, and his description of the Scythians and their country in the fourth book.

There is however something vague in the descriptions of Herodotus, for want of a means of referring to the position of places as determined by astronomical observations. Herodotus indeed was apparently not fully acquainted with the state of science, and particularly astronomical knowledge, as it existed in his age. Thales had some time before calculated an eclipse of the sun, and from his epoch astronomy attracted the attention of the Greek philosophers, and facts

in this science began to accumulate. It was however soon evident that most of these facts lost a great part of their value, from the circumstance of the position of places not being ascertained. Astronomers therefore were led to devise a method of fixing the latitude and longitude of a place; and though this method, when compared with our practice, was extremely rude and imperfect, yet it must be considered as having materially contributed to the improvement of geography. With the help of such astronomical observations as were made by his predecessors or himself, Eratosthenes formed the first system of geography founded on a basis which in some degree approached to truth. He determined the geographical position of a great number of places, many of them hardly known to Europeans, but these determinations were often founded on vague information, and consequently were in a great degree conjectural. Still his map gave a much truer image of the figure of the world than philosophers had formed before him, as he took care to subject his information to a strict examination.

While his successors were slowly improving his work, the historians, following up the plan traced by Herodotus, enriched geography with the description of those countries which at the time of the historian of Halicarnassus were not known, or at least only imperfectly known in Greece. Among these historians Polybius deserves particular mention. His geographical descriptions of the countries which enclose the western portion of the Mediterranean Sea are as good as, if not superior to, those by Herodotus of the countries between the Caspian Sea and the Gulfs of Persia and Arabia. About his time, or shortly afterwards, it would seem that several persons undertook travels into remote countries, in order to investigate their physical character and to ascertain the accuracy of such information as had reached them by hearsay. The most conspicuous among these adventurers was Posidonius. Like Alexander von Humboldt he went to the then remotest country of the earth, to Iberia, which was as noted for its mines of the precious metals as South America and Mexico are in in our times; and though only a small portion of the information which he collected is come down to us, he seems to have paid great attention to nearly all the objects of inquiry which the German philosopher has investigated.

The geographical information collected by these eminent travellers and many others of less note was scattered over a great number of works, access to which, in the circumstances of those times, was necessarily difficult. Strabo, a native of Asia Minor, who wrote in the time of Augustus and Tiberius, undertook to incorporate in one work those scattered materials and to add the information which he had acquired in his own travels. His object, according to his declaration, was to compose a work which should be useful to those employed in the administration of countries. He accordingly discarded everything which was only of temporary importance, and described each country according to its permanent physical character. In a few words he informs his reader of the extent of each country under description, and its chief political and historical divisions. Passing on to the detailed description of these divisions, he follows much more nearly the course of our modern travellers than that of our geographers. Mountains, plains, valleys, rivers, and towns keep their true position with respect to one another; productions and climate are mentioned in their proper place. A few short observations on commerce and the articles of export conclude his description. By this judicious arrangement the sagacious Greek geographer avoided causing to his readers that weariness which every one experiences in perusing common geographical books, in which every object is as it were rooted out from its natural place and transported to a foreign spot. We cannot help thinking that the method of treating geography adopted by Strabo ought still to be considered as a model, and ought to be again introduced into works of this class; and we find that Charles Ritter, in his justly esteemed geographical works, strictly adheres to the plan of Strabo.

Whilst the geography of Strabo was extensively used all over the Roman world, the astronomical school of Alexandria continued collecting materials for the purpose of completing and perfecting the system of geography framed by Erastosthenes. These collections enabled Ptolemy to form his geography, which is hardly anything else but a catalogue of places according to their estimated or determined geographical position. In its time it was certainly a very useful work, but its value to us consists chiefly in showing how far the Greeks had carried their knowledge of the surface of the globe. From the time of Ptolemy up to the fourteenth century scarcely anything was added to what he left behind him.

The downfal of the Roman Empire, and the occupation of Western Europe by barbarous nations who were hardly acquainted with the elements of civilized life, suddenly extinguished all scientific research. Many centuries elapsed before these nations made such progress in civilization as to enable them to turn their attention to science. Geography, which shared the fate of the other sciences, was however revived sooner than the rest, and the circumstance which led to this was the travels of the Venetian, Marco Polo. Though his accounts were rejected by his countrymen as mere fictions, or at any rate were treated as great exaggerations, some German scholars at Nürnberg took a different view of them. As Nürnberg at that time was one of the greatest trading places on the Continent, and for that reason closely connected with the first commercial houses of Venice, these learned men soon procured a copy of Marco Polo's travels. For the other countries of the world taking Ptolemy as their basis, they introduced the principal geographical facts contained in Polo's travels into their globes and maps, as an addition to the knowledge transmitted by the astronomers of Alexandria. But Marco Polo had made no astronomical observations, nor had he even mentioned the length of the longest day at any place. The German geographers were therefore obliged to determine the extent of the countries which he had traversed by his vague estimates of days' journeys; but the length of these journeys was greatly exaggerated by them, as they were entirely unacquainted with the peculiar character of Eastern Asia. The consequence of this was, that on their maps and globes Asia extended over the whole of the Pacific, and its eastern shores were placed very nearly where the Antilles are situated. This error of the geographical school of Nürnberg was attended with very important consequences. Columbus, relying on their estimates, considered that the shortest way to arrive at the eastern parts of Asia would be by sailing to the west. He found America: but the same school of geographers whose errors had induced him to venture on such a voyage deprived him also partly of the honour due to his great discovery. Baron von Humboldt has proved that the very slow and insecure communications which then existed between Spain and Germany brought the news of the discovery of the New World to the geographers of Germany together with the names of Columbus and Americo Vespucci, and that the Germans thought that Americo was the true discoverer of the new continent, which accordingly obtained from them the name of America, a name that has become universal.

The first half of the sixteenth century was entirely employed in discovering the extensive coasts of America, and the countries and islands lying along it, and in the Indian Ocean; and geographers were fully employed in inserting these new discoveries in their maps according to such determinations of positions as they could obtain. In all the geographical works written during that century this characteristic is observable. They resemble much more the geography of Ptolemy than that of Strabo. But what could geographers then know of the interior of countries whose very coasts were yet hardly laid down with accuracy even in a few places?

In the mean time the other sciences had been revived and with them also the study of antiquity, which gave a different turn to the study of geography during the seventeenth century. Many persons well informed in antient history visited Greece and the countries of Western Asia, with the view of examining those parts which had once been the theatre of great events. Such *historical* travellers were very numerous during the second half of the seventeenth and the first half of the eighteenth century; and though at first they confined their researches chiefly to such places as had obtained some historical celebrity, they afterwards extended their views to the physical character of the countries in which such places were situated, and gave us some excellent descriptions of them, such as we find in the travels of Chardin, Shaw, Pococke, Chandler, and Carsten Niebuhr. These travels greatly contributed to the improvement of geography as a science. They brought history and geography again into close connection. Before this time geographical works contained hardly any thing beyond a dry catalogue of names of places, rivers, and political divisions. But in describing the

still existing ruins of places celebrated in ancient history, geographers were compelled to go back to those antient authors who had treated of these places, and thus a part at least of the geographical knowledge of Herodotus, Polybius, and Strabo, was transplantod into our modern geographical treatises. Thus a great deal of very interesting and useful matter found its way into treatises on geography, which had hitherto been entirely excluded, partly because it had not been known, and partly because it had been considered as foreign to the object of the science. If any person will take the trouble to examine any of the geographical works of the middle of the seventeenth and eighteenth centuries, he will find that more than three parts out of four of their contents have changed in the course of 100 years.

Still the science of geography remained in a very imperfect state. Only a few spots in each country had been described with any degree of precision. The peculiar character of an entire country, and of its component parts, had never been made a subject of inquiry. It had never been a subject of investigation, how far the physical character of a country was favourable or adverse to the civilization of its inhabitants. This has now in a great degree been effected by the naturalists and other men of science, who during the last and the present century have visited nearly every part on the globe. In course of time the researches of travellers and voyagers have thus been extended to a greater number of new objects. At first they limited their labours to the extension of Natural History, adding a few observations on the countries through which they passed. Thus Tournefort, who travelled through Asia Minor, Armenia, and Persia, may be considered as the first travelling naturalist. But by examining the natural productions of a country travellers were insensibly led to an investigation of their climate. In their attempts to establish the mean temperature of different places, and its effects on vegetation and animal life, they soon perceived the great influence which a variation in elevation above the level of the sea has on both. Thus they gradually learned that nearly every country is divided by nature into a smaller or greater number of parts materially differing in climate and natural productions. The knowledge of this fact mainly contributed to give geography a new character, and to introduce new and important elements into the geographical descriptions of countries, such as we find in the works of Pallas, Sir Francis Hamilton, and Alexander von Humboldt. What these great men, and several of their less distinguished predecessors did for the countries out of Europe, has been accomplished with equal success for the European continent by the labours of numerous excellent writers.

Geography, then, in its present state, and in its practical application, has for its object the determination of all those facts, as to any given country, which will enable us to judge of its fitness to provide man with food and to promote his civilization. As a science, its object is to deduce, from all the observed phænomena within its sphere, those general principles which enable us from certain known facts, as to any given country, to infer others not ascertained, and which indicate what are, as to each portion of the earth, the proper objects of inquiry. It is not every part of a country that possesses equal advantages for the habitation of man. Some parts are more favoured by soil and climate than others. There are also tracts which are inferior in both respects, but by the aid of other advantages, especially those of easy communication, have risen to a higher degree of prosperity and cultivation than many others in their neighbourhood which are more favoured in soil and climate. No correct knowledge of a country can be acquired unless the parts of it which are distinguished by their natural advantages or disadvantages are separated from each other, and unless a particular description is given of each, with its extent, and the proportion which it bears to the whole country. The first business of the geographer then must be to make this separation. His next business is to give a particular description of each of these natural divisions, beginning with the most essential fact, its elevation above the sea. If it is a valley, he notices its elevation at its origin and its termination, observing where its descent is regular and gradual, and where it declines with greater rapidity. If it is a plain, he notices at least its mean elevation, and observes in what cases it extends in a flat level, and in what cases it has an undulating surface; also, if a smaller or larger portion of it is covered with swamps. This description of the surface is followed by that of the water-courses or drainage. After determining the sources of a stream, and the direction and length of its course, he mentions the amount of depression of its bed below the general surface of the valley or of the plain; and when it drains a plain, if there are bottoms or river-valleys formed on the surface of the plain, he mentions also the general extent of these bottoms. The distance to which a river is navigable is the next object of inquiry: if there are any natural impediments to the navigation, and if any successful attempts have been made to remove them, these facts also require mention. The extent of surface drained by each river, or by all the streams which ultimately unite in one channel; in other words, the extent of each river-basin must also be ascertained. Next follows the climate. Here two points especially are to be attended to; the temperature of the air, and the quantity of rain which falls, and of moisture in the atmosphere. As for the temperature of the air, not only the mean annual temperature is to be given or ascertained, but also that of the different seasons, and the regularity or irregularity of its changes, as such changes generally affect the health of the inhabitants in a sensible degree. As to moisture or rain, not only the annual quantity that falls should be noticed, but also its distribution at the different seasons. The character and the duration of the seasons must also be observed, and the prevalent winds; and especially the effect of the seasons on the progress of vegetation. It is necessary to know all these facts before a just notion can be formed of the fitness of any given tract of country for providing a population with food. And this capability of a country for the production of food, or in other words its capabilities for agricultural purposes, is one of the most useful branches of geographical inquiry. The nature of the soil and its fitness for different productions adapted to the climate of the tract, are therefore matters of primary importance in a geographical description. It is here proper to enumerate those objects of agriculture which are raised for food and as materials for clothing, and the proportion between the labour which they require and the value of the produce: and in the next place such productions as could be raised with ease and advantage, but which are not cultivated to any extent. Those objects which form articles of export, and enter into the market of the world, also claim a notice; and also such indigenous plants as are either of some use in the domestic economy of the inhabitants, or furnish a commodity for foreign trade. It is not the business of the geographer to enumerate all the particulars which constitute the botany or zoology of a district, for that would enlarge his science beyond all bounds and encroach upon the limits of others. The principle that must guide him in determining how much and what he must include in his geographical description of the botany and zoology of a country, will always be indicated by the question—does the thing or object inquired after materially influence the capability of the country as a place fitted for the residence of man? Besides the useful domestic animals, it is only necessary to mention such wild ones as are useful to the inhabitants, either by providing them with food and clothing, or by supplying an article of commerce; and these animals only need be mentioned when they are found in great numbers. As for the mineral wealth of a country, the notice of that will be limited to those substances which are worked for the use of the inhabitants or for exportation.

In this way we conceive the geographer ought to describe in detail each natural division of a country, and when he has described two such tracts which are contiguous to one another, he must point out the boundary-lines by which nature has separated them, and the obstacles which she has placed to their mutual intercourse. If he finds that such boundary-lines are formed by mountain-ranges, he has to notice their mean elevation, and likewise that of the mountain-passes by which the dividing range is crossed. He must also add what natural productions of the range contribute to the sustenance or comfort of the inhabitants of the adjacent tracts. When the range has numerous offsets and extensive valleys, and consequently occupies a considerable part of the country, he must treat it as a separate natural division, and describe it in detail like any other natural division.

When the geographer has described every natural division of a country in this way, and incorporated in his description the best attainable information on all the above-mentioned points, we think that he has done his duty, and ma,

consider his labour as terminated. But our geographical treatises still contain other matter, which is not comprehended within the above enumeration of objects belonging to the science of geography. This extraneous matter is taken either from statistics, or from what is popularly called natural philosophy or from history; and it ought to be considered how far it is expedient to admit such matters into geographical treatises.

As to statistical facts the greatest caution ought to be used. Most of them are of such a description that they are true only for a very short time, and then lose that character. Such things, according to the opinion of Strabo, ought not to be received among things which are of an entirely different nature. Yet the knowledge of a country would properly be considered as incomplete without a general notion of the most commercial and manufacturing towns within it. Such towns must therefore be mentioned, and at the same time it should be stated how far they facilitate the internal and external intercourse of a country. The political divisions of the country may be added or omitted; when added, they should be mentioned briefly, and in a very general way. Good maps supply any deficiency in geographical works in this respect.

We do not venture to exclude entirely from geographical works all mention of natural phænomena peculiar to a country. Some of these, as volcanoes and earthquakes, though they do not exercise a permanent influence on the welfare of the inhabitants, are frequently destructive of property or life, or of both. For that reason they ought to be noticed. Such phenomena as warm or mineral springs seem also to claim a notice, especially if distinguished by peculiar characters, as the Geysers in Iceland.

It is more difficult to determine how far it is proper to describe the remains of antiquity in geographical works. When the ruins of a great city still exhibit remarkable traces of its antient grandeur, they certainly cannot be altogether excluded. But the true solution of these and other difficulties of the kind that may be suggested as to the matter admissible into a geographical treatise, seems to be this: these subjects are *specialties*, and if they belong to geography at all, do not belong to it as necessary component parts of it, but stand to it in such a relation as to admit of being introduced or omitted according to the taste and judgment of the writer, who in this, as in all branches of knowledge whose boundaries are incapable of precise determination, will show his good sense and his clear comprehension of his subject as much by what he omits as by what he takes in.

The political institutions of a country belong to its history, and not to its geography, and ought certainly to be excluded from geographical treatises, though they form a necessary part of most statistical and of all historical works.

The importance which geography, as a science, has attained of late years, has suggested the formation of Geographical Societies. The main object of such societies is, or ought to be, to encourage the accumulation of facts as to countries that are little known. The first Geographical Society was established at Paris in 1821. The 'Transactions' of this society, in five volumes, in 4to., contain very little original information. They are chiefly valuable for the history of geographical knowledge: they contain complete translations of the travels of Marco Polo, and of the geographical works of Abulfeda and Edrisi. The third volume contains the 'Orographie de l'Europe,' which presents a tabular view of the elevation of numerous mountain summits and other positions: it is executed with considerable correctness, and is a very useful work. The second society of this kind was established at London, in 1830, and called the Royal Geographical Society. This society publishes annually a volume of Transactions, under the title of the 'Journal of the Royal Geographical Society.' We think it may be safely asserted that there has seldom appeared a work which, for amount of original information, can be compared with these Transactions. This country indeed has greater facilities for procuring geographical information than any other, and the society has not failed to make the most of these resources. The naval officers employed by Government and the East India Company in surveying various parts of the coasts of Asia, Africa, America, and the Mediterranean Sea, have made valuable contributions to the volumes of the society. The information contained in these communications is distinguished by a correctness proportionate to the attention which their professional duties required of them. Of this character particularly are the accounts of the coasts of South America, by Capt. Phillip Parker King and Capt. Fitzroy. Various persons who have been sent out by Government in a public capacity have added to the stock of useful information: as Lieut. (now Capt.) Washington, on the empire of Marocco; Mr. Brant, on Armenia and Asia Minor; Major Mitchel, on the interior of Australia; and others. Many travellers, who had no intention of publishing their observations in the shape of a book, have communicated them to the world through the 'London Geographical Journal;' and it is certain that most, if not all, the information contained in many of those valuable papers would have been lost to science but for the existence of the society. Though the annual contribution of each member is but small (2*l*.), by a judicious management of their funds and the aid of Government the society has been enabled to send out travellers to such of our foreign possessions as are yet imperfectly known. Thus Capt. Alexander was sent to the Cape of Good Hope, Mr. Schomburgk to British Guiana, and Capt. Back to the Arctic Regions, and other expeditions are in contemplation. The success of the British Society has led to the formation of a similar society at Berlin (1833), and at Frankfort-on-the-Main (1837), which however, up to the present time, have not published any Transactions. A Geographical Society has also been formed at Bombay, which has for its object 'the elucidation of the geography of Western India and the surrounding countries.' (*London Geograph. Journal*, vol. iii. 1833.)

GEOLOGY. § 1. Historical Notices of the Progress of Geological Science.—The science of the earth (as the Greek words γῆ and λόγος may be translated) includes, in a large sense, all acquired or possible knowledge of the natural phænomena on and within the globe; whether these be now of frequent occurrence, the result of the existing combinations of physical agencies, or remain as monuments and measures of those agencies in earlier periods of the history of the planet.

Some of these phænomena are witnessed in connexion with inorganic bodies, and depend in a great degree on the laws of force which appertain to and distinguish from each other the particles of matter; others are exemplified in organised structures endowed with vital functions related to those structures; and there may yet be distinguished a third order of effects, influencing and combining with both of the former, and depending on laws of force which affect the whole mass of the globe, as gravitation, or derived from extraneous agency, as light.

If at any certain epoch (as the present time) the phænomena thus classed were known in detail, and reduced to general laws, which truly expressed the individual cases, the actual condition of the earth would be really known: if further it were possible to collect sufficient evidence from monuments preserved in the earth of its exact state at some former epoch, the variations to which terrestrial phænomena are subject would be disclosed; and by the comparison of several such surveys, taken at distant times, the laws of these variations would be revealed, with an exactness proportioned to the certainty with which the *intervals of time* were determined. These laws of the *variation* of the condition of the globe at successive epochs, combined with the laws of chemical, vital, and mechanical action, which are assumed to be essential and constant, independent of time, and exempt from change, will furnish one, and only one, satisfactory general contemplation or theory of the origin, structure, and successive changes of the globe, considered as a part of the planetary system revolving round the sun.

To reach this general theory is the highest ambition of modern geology. The discovery of the right method of proceeding in this attempt is of modern date; and all the most important steps of the advance towards this 'high point of knowledge' have been taken within the memory of the generation now passing away. If, as Sir John Herschel tells us ('Discourse on the Study of Natural Philosophy,') 'geology, in the magnitude and sublimity of the objects of which it treats, undoubtedly ranks, in the scale of the sciences, next to astronomy,' it owes this great distinction to the humility with which its modern cultivators have sought within the ranks of inductive science better methods of research and purer models of reasoning than those afforded by the treasures of ancient philosophy which have

been preserved to our time. Nor is this the peculiar boast or shame of geology. Every branch of the study of nature was equally transformed by the introduction of the Baconian methods of interpretation of nature; all the natural sciences have advanced together; the knowledge of the constant laws in the visible creation has been continually perfected; and thus, while the study of the long-past operations of nature has been imbued with the exactness of chemical, zoological, botanical, and physical research, the dry annals of one æra in the history of the world have been enriched into a long, instructive, and eventful history.

Geology of the Greeks.—Among the antients the notices of geology are few, and the interest belonging to them is of a peculiar character. When chemistry, whose operations manifest the existence of peculiar laws of force among the particles of matter, was wholly unknown—when the living wonders of creation were but slightly considered by philosophers intent on abstract principles—no accurate survey could be taken of the condition of any one part of the surface of the earth. But a small part of that surface was known to any one people, and only in a few situations were the changes in the aspect of nature so extensive as to arrest the attention of the geographer, or so violent as to excite the philosopher to search for the cause.

Among the anciently-peopled and commercial states of the eastern shores and islands of the Mediterranean, both these circumstances concurred, and there first awakened the powerful intellect of Greece to speculation on the varying condition of the land and sea. Lower Egypt is the gift of the Nile, and the powerful and learned people which possessed it were compelled by the circumstances of their situation to study the nature and effects of the annual floods of the river. Herodotus (born 484 B.C.) estimates (ii. 11) that the Nile, if diverted into the Red Sea, would fill that long gulf in less than 20,000, or even 10,000 years. The notion of change thus distinctly impressed upon the minds of the Egyptian priests was developed in a general and philosophical form, and illustrated by special references to an extended series of geological phænomena by their pupil Pythagoras (born 586 B.C.). According to the summary of their doctrine, and the tenor of the illustrations of it which are given by Ovid, we cannot avoid seeing, even through the injurious ornament of verse, that Pythagoras had acquired a clear conception, a 'distinct idea,' of nature as existing by the concurrent action of many complicated powers, which were subject to continual or sudden variation in their relative intensity. Changes of the relative level of land and sea, and divulsion of islands from the mainland by the action of earthquakes, are distinctly announced; the displacement and limited duration of volcanic vents, such as Ætna; the degradation of land by the action of atmospheric agency ('et eluvie mons est deductus in æquor'); the submersion of land which had been formerly peopled—

> Si quæras Helicen et Burin, Achaidas urbes,
> Invenies sub aquis.—(Ovid, *Metam.* xv., l. 293.)

the production of new land, and the occurrence of marine shells far from the present seas;—these phænomena, distinctly observed and analyzed, and clearly produced in proof of a general proposition, justify a higher degree of admiration for the Samian philosopher than is due to any of the merely speculative writers of antiquity.

Similar observations appear to have served as the groundwork of Aristotle's exposition ('Meteorologica') of the perpetual fluctuation of natural phænomena; the alternate excitation and rest of parts of the earth's surface. (See particularly the end of the first book.) But it is in Strabo (nearly contemporary with the commencement of the Christian æra) that we find the most sensible views of the causes of the occurrence of marine shells far from the shore, the displacements of land and sea, the rising of islands, the formation of straits, and other great geological phænomena.

Having stated the views of Eratosthenes, as to the general fact of the earth's globular form, and the production of the numerous minor inequalities on its surface, by correspondingly numerous 'proximate causes,' such as the operations of water, heat, concussions, vapours, and the like, he examines the opinions of Xanthus and Straton, which Eratosthenes had preserved. (Strab., *Casaub.* 49, &c.)

The explanation of Xanthus (derived from an historical fact) that the phænomena in question were due to great droughts which had diminished the originally greater expanse of the sea, is regarded as insufficient; and Strabo's hypothesis of adjacent but disconnected seas, one of which being raised to a higher level by sediment on its bed, had forcibly opened itself a passage to the other, the Euxine to the Propontis, the Mediterranean to the Atlantic, is shown to contradict received physical theorems. Strabo proposes to account for these and other phænomena by the general speculation that the land, not the sea, is subject to changes of level, and that such changes more easily happen to the land below the sea, 'because of its humidity.'

The action of Ætna in moving the shores of Sicily and Italy is spoken of in a familiar manner, and a long description of phænomena bearing on the discussions succeeds, in which the opinions of many authors are quoted.

Fifteen hundred years elapsed after the æra of Strabo, without adding anything material to the stock of geological facts, or the limited range of rational theory; for, excepting the work of Omar (10th century), in which the phænomena of 'new lands,' and marine shells found inland, are referred to a 'retreat of the sea,' there is not, on the subject of geology among the Arabian writers, even the usual amount of comment on the writers of Greece and Rome which characterizes the literary efforts of the learned Moslems. (Lyell's *Principles of Geology*, vol. i.)

Revival of Geology in Europe. Nature of Organic Fossils.—Italy, the fruitful mother of modern physical science, offered in her volcanic cones, ranges of mountains, and shelly marls at their bases, the most attractive points to the intellectual activity of the precursors and contemporaries of Galileo.

So recent are sound views of the true nature and relations of the organic forms buried in the earth, that it is not very difficult for English geologists to imagine the fierceness of the contest in which Fracastoro (1517) was involved, to defend his opinions that the 'formed stones' (as they were afterwards termed in England) were not 'lusus naturæ' produced by a 'plastic force,' but really the remains of fishes, mollusca, &c.; and that they had not been rudely scattered over the surface by the Noachian flood, but buried at great depths by a more regular operation of water. These important assertions were the subject of controversy for nearly two centuries in Italy; and in establishing the true nature of the organic remains, Cardano, Colonna (1666), and Scilla (1670) overlooked or disregarded the more seriou and more seducing error of ascribing their inhumation in the earth to a general deluge. Georgius Agricola (1546) adopted the wrong view of the origin of organic fossils: but Steno (1669) of Copenhagen, opened a new line of inquiry, by noticing the succession of rocks; distinguishing some as having been formed before the creation of animals and plants; insisting on the original horizontal position of the strata; tl proof of violent movement of the crust of the globe, afforded by the now inclined position of such strata in mountainous countries; and the variations of condition to which the surface of Tuscany had been exposed, by repeated overflows and retirements of the sea. (Lyell, *Principles of Geology.*)

Scilla's masterly work on the organic remains of Calabria, published both in Latin and Italian ('La Vana Speculazione disingannata dal Senso,' 1670), may be considered as closing the long dispute in Italy, among men of philosophical minds, on the subject of the nature of organic fossils. Its was comparatively very short in England, for Plot (in 1677) is almost the only writer who really and heartily embraced the doctrine of an occult cause, to escape from the consequence of admitting the true origin of the 'formed stones,' and Scilla's work was abridged for the 'Philosophical Transactions' in 1695-6, by Dr. Wotton. Lister's early views on the matter (1678) express a doubt, arising from knowledge; he saw that the fossil shells were *different* from the living types, and proposed the alternative of a terrigenous origin, or an extinction of species. Ray (1692) on 'Chaos and Creation,' Woodward's 'Natural History' (1695), Scheuchger's 'Herbarium Diluvianum,' of the same date, afford proof of the victory gained by the observations of naturalists over the closet speculations of metaphysicians, on the origin of fossil shells in most parts of Europe; and indeed, in France, Palissy's lectures and writings (his last publication bears the date of 1580) may be said to have established the truth contended for.

Submersion and Desiccation of Land.—The victory was unproductive. In consequence of coupling with the obvious truth a fatal and fundamental error, the shells and other exuviæ of the sea were maintained by Woodward

and a host of contemporaries and followers to have been brought upon the land by the 'universal deluge,' as all writers except Quirini (1676) agreed to term the Noachian flood. This error might speedily have been swept away by the early arguments of Palissy, the investigations of Steno, and the striking generalization of Lister; but that, unhappily, from a philosophical question, it became a theological argument. The fossil shells far from the sea were held to be physical *proofs* of the truth of the Mosaic narrative; and the occurrence of these shells at various depths and heights, and in rocks of different kinds, only furnished additional arguments in favour of the violence of that flood, which not merely was supposed to have covered the mountains, but to have entirely broken up and dissolved the whole frame-work of the earth, and to have deposited the materials according to their relative gravity. In vain had Hooke, Ramazzini, and Ray, previous to 1700, protested against the absurdity of this hypothesis, which Leibnitz appears to have despised; it was reserved for Moro (1740), Buffon (1749), Linnæus (1770),* and Whitehurst (1792), to hasten its banishment from philosophy; and even at this day there are persons who from time to time revive the discussions of the sixteenth century, as a point of importance in Christian theology.

To account for the dryness and elevation of the countries where fossil shells occur, there are but two hypotheses: the shelly bed of the sea has been raised, or the ocean has abandoned its antient place. Many of the Italian geologists adopted the former view, and in consequence repeated the opinions and reasonings of Strabo, with the advantage of referring to the elevation of Monte Nuovo near Puzzuoli, in 1538 and Santorino, 1707 (Majoli, 1597; Vallisneri, 1721; Lazzaro Moro, 1740). The better order of English writers (Hooke in 1668, Ray in 1692—earthquakes were then frequent in Europe) adopted the same views; and Hooke in particular presented the phenomena of earthquakes and volcanoes in the form of a general speculation, which served to direct the opinions of subsequent systematists like Whitehurst.

Diluvial Hypothesis.—None of the philosophers who were concerned in establishing the truths connected with organic remains were seduced by their success into the vanity of proposing any general hypothesis on the formation of the earth. But this creditable modesty, so characteristic of the spirit of induction which animated Fracastoro, was not at all imitated by the fanciful diluvialists, who followed in the wake of Woodward, Burnet, Whiston, Catcott, and others. To determine whence came the water which held at once in suspension the whole of the exterior parts of the globe, and whither it retreated, was necessary to help out their extravagant proposition.

No ordinary hypothesis would meet these formidable problems, and if we recollect that in answering them it was further required to adopt views which should not trench on the arbitrary notions then entertained as to the meaning of certain passages of Scripture, we shall be disposed to regard even the monstrous violations of physical truth which appear in the hypotheses of Burnet, Woodward, and Whiston, without surprise. Omitting minor circumstances which it would be useless to particularize, Burnet, Woodward, and their followers agreed in adopting the notion of an interior abyss below the crust of the earth, as the general reservoir from whence the waters rushed to cover the earth, and into which they again withdrew after the diluvial devastation was completed. Whiston, who was far better versed in physical science than either of the others, introduced in addition the notion of extraneous force; he brought a comet to envelop the earth in its misty tail, to cause violent rains, raise vast tides in the internal abyss, and thus effectually destroy the external crust of the planet. It appears probable that mankind seldom permit their imaginations to take such dangerous flights without necessity; the hypothesis is made to suit the conditions of the moment, and the chief error consisted in including among these conditions a narrow and unreasonable interpretation of the Mosaic narrative. This error lies even yet at the root of some well-meaning speculations, which from time to time arise, a century after their proper date, for the avowed purpose of reconciling geological and scriptural truth.

* 'Ubi testacea et lithophyta fossilia existunt in magna copia, ibi quondam fuere littora aut abyssus, cum sint mera vestigia maris, omni historia antiquiora; diluvium vero non demonstrant, sed tantum longioris ævi rudera.' (*Syst. Nat.*, Foss. Petrif.)

General Speculations.—The diluvial hypothesis has been sufficiently traced to its natural consequence—a monstrous violation of the laws of nature; another general view, first distinctly stated by Vallisneri (1721), has been the source of long-continued errors. Struck by the general diffusion of marine fossils, he supposed the ocean to have once extended over all the earth, and to have gradually subsided, leaving everywhere the traces, not of a violent flood, but of the quiet super-fluctuation of water. Perhaps Vallisneri found this notion in his travels; at any rate, the notion of a universal subsidence of the ocean appears to be the German element of geological hypothesis, for Werner made it the basis of his so-called theory of the earth, and thus obscured with a physical improbability the important truths which he had established concerning the succession of strata.

Starting from an entirely different point, Leibnitz (in 1680) proposed one of the most general contemplations which has ever appeared in geology. He commences with the concentration of the mass of the globe in a state of great heat; accounts for the fundamental primary rocks by the refrigeration of the surface, and explains the violent action of water upon them by the collapse of this crust on the contracting nucleus. Sedimentary strata are the natural consequence of these watery movements subsiding to rest, and by the repetition of the phænomena such features are imparted to the earth as to insulate many of the later deposits, and render it necessary to be prudent in determining whether local or general agency has been concerned in producing them. It would be difficult in general terms more clearly to announce views now prevalent among those who contemplate geology in connection with physical science. Cordier, Von Buch, and De Beaumont have endeavoured by this speculation of Leibnitz to explain some of the principal phænomena of geology—the elevation of mountains; but the theoretical merit of Leibnitz was little regarded in England till Mr. Conybeare explained his views to the British Association at Oxford. (*Reports of the British Association.*)

The effect of Laplace's and Fourier's theorems on the operation of interior heat is likely to be augmented by Mr. Hopkins's labours (*Camb. Phil. Trans.*); and the grand views of Sir W. Herschel as to the constitution of the universe have already been applied to the history of the earth by Mr. De la Beche (*Theoretical Researches*), and will probably become an important addition to the Leibnitzian theory.

In the works of Ray (1692), and Hooke (1688), we may trace the revival of another general speculation (that of Pythagoras), which, instead of deducing the leading geological appearances from some primal condition, with Leibnitz, supposes the essential condition of the world to be one of continual change, and assigns to modern causes in action a measure of force capable of producing, in a sufficient lapse of time, phænomena as important as those of antient geological date.

Lazzaro Moro's views (1740) have the same tendency to recall speculation to the employment of real causes seen in daily operation; Buffon (1749) appears to have unsuccessfully attempted the union of the fundamental view of Leibnitz and the regard for existing agencies shown by Ray; Dr. James Hutton, of Edinburgh, rejected all inquiry as to the beginning of the world, and gave himself up entirely to an explanation of the phænomena visible in the crust of the earth, on the principle of a continual degradation of land by atmospheric agency, the consequent formation of sedimentary strata on the bed of the sea, and the periodical compensation of these effects by the action of internal heat raising the bed of the sea, with the stratified deposits thereon. A continual destruction of the existing land through the agency of water, and an occasional uplifting of new continents from the ocean bed—these are the most striking points of the Huttonian theory of the earth. Mr. Lyell differs from Dr. Hutton chiefly by recurring to the original form of the speculation as we may conceive it to have existed in the mind of Pythagoras or Aristotle, could either of those great men have become acquainted with modern science. For instead of the occasional occurrence of a violent upward movement of the bed of the sea, the author of the 'Principles of Geology' appears impressed with a distinct idea of a continual compensation among the agencies of nature, the perfect equality of modern and antient physical forces, and the possibility of explaining all, even the grandest, of antient geological phænomena by

causes now acting, and acting with their present intensity. No more definite or general proposition has ever been advanced in geology, and its effect has been highly important, even in the estimation of those who do not entirely admit it.

Inductive Geology.—Geological appearances are usually of a complicated character, and must be analyzed into their elementary parts before the inductive process, which requires the comparison of facts agreeing or differing with respect to a certain quality, can be usefully applied. Fossil shells must be distinguished into fluviatile or marine, identical with or different from recent kinds; rocks must be considered as to their chemical nature, mechanical structure, geographical and other characters, before any valuable inferences can be gathered from them. Though this kind of labour is not discoverable among the works of the Greeks which remain to us, we must not hastily deny that they attempted it. In modern times Fracastoro, Palissy, and Steno, by distinguishing the groups of strata; Lister, by discriminating recent and fossil species of shells, and by noticing the geographical relations of rocks; Woodward, by his industrious collection of specimens and methods of arrangement; Packe, by his remarkable chorographical map of Kent; Lehman (1756), and Arduino, by their classification of rocks, according to the relative periods of their production; and Mitchell (1760), by his masterly determinations concerning the relation between the ranges of mountains and the inclinations of the neighbouring strata—have stronger claims to grateful remembrance than are due to those who with much labour have merely produced volumes of empty speculation.

Distinction of Primary, Secondary, and subsequent Deposits in Germany.—John Gottlob Lehman (1756) may be considered as having the best claim to a clear enunciation and proof of the different age and relative position of classes of stratified rocks. In the French translation of his work ('Traité du Physique, d'Histoire Naturelle, de Mineralogie, et de Metallurgie'), he says, 'Nothing is more natural than to group all mountains in three classes. The first includes mountains which are coeval with the formation of the globe: the second class was produced by a revolution co-extensive with its surface; the third consists of mountains which owe their origin to particular accidents or local revolutions.' This was not a mere speculation of what might be convenient, for, he adds, 'The mountains of the first class are high, sometimes insulated in the plains, but generally connected in a chain, traversing considerable parts of the earth. They differ from those of the second class by their elevation and extent, by their interior structure, by the mineral substances associated with them.'

Pallas (1779*), in addition to these general views, maintains that the granitic rocks, then taken as primary, were never formed by water, because they do not occur in beds, nor contain organic remains; that the secondary mountains were produced from the disintegration of granite; and the strata of later date, by the wrecks of the sea elevated and transported by volcanic eruptions and subsequent inundations.

Succession of Strata.—To these distinguished authors, Werner, professor of mineralogy in Freyberg (1775), was a worthy successor. The first important addition to previous knowledge on the subject was contained in his 'Kürze Klassifikation und Beschreibung der verschiedenen Gebirgsarten' (1787), where the mineralogical distinctions of rocks may be viewed as a completion of the labours of the earlier Swedish writers, Cronstadt, Wallerius, Linnæus, &c., all of whom had glimpses of the geological relations of the rocks they classified. It does not appear that Werner proposed any views as to the geological relations of rocks in advance of those of Lehman or Pallas till 1790 or 1791, when the doctrine of 'formations' was explained in his lectures, which indeed was a powerful mode of diffusing instruction; for his amiable manners, disinterested enthusiasm, and various knowledge, gave him a strong ascendency over the numerous pupils who, from various countries, flocked to Freyberg. In 1795 (or 1796 according to Dr. Fitton) Werner had matured his views as to the classification of all the stratified rocks, and from this it is easy to estimate the real claim of Werner to a high place in the ranks of modern geology. The great advance made by Werner consists, not in propounding the distinctions of great classes of rocks, for this had become a common idea in Europe, but in practically analyzing these classes into their constituent groups, tracing the order of succession among them, assigning their mineralogical characters to each, and generalizing this local truth into the doctrine of formations universally succeeding one another in a settled order of time. Parting from Freyberg with a better method of mineralogy, and a more developed system of the succession of rocks than was previously known, the pupils of Werner carried the influence of his name and opinions over the world, and, unfortunately, the crude hypothesis which was connected with the rich truths he taught was embraced with an ardour very disproportionate to its value.

* 'Journal de Physique,' 1779.

In France, Rouelle (about 1760?) had acquired ideas apparently as general and fully as well supported by local knowledge as Lehman. His views on organic remains were quite in advance of the time. In England the notices of stratification, by Mr. Strachey ('Phil. Trans.,' 1719), the Rev. B. Holloway (1723), and the Rev. John Mitchell (1760), are of great importance. Strachey presents an accurate section of the coal strata of Somersetshire, with reflections on the strata above them, and their geographical boundaries; Holloway describes the geographical relation of the sand-hills of Woburn and Shotover, yielding fullers-earth, to the chalk hills on the east, and the oolitic tracts on the west; but Mitchell enters into a general and masterly discussion on the relation between geological structure and the geographical features of the surface not to be paralleled for fully fifty years.

Whitehurst must here be mentioned with honour. His 'Inquiry into the Original State and Formation of the Earth,' 1778, is of small value for the purpose he proposed, but it contains important facts towards a right conception of the structure of the earth. His 16th chapter, entitled 'The Strata of Derbyshire and other parts of England,' is full of information, principally derived from the miners, but evidently well methodized in his own mind. How could the geologists of England neglect such passages as these following, which are merely the scientific exposition of truths known for hundreds of years previous by skilful miners in all regions of stratified rocks? 'The arrangement of the strata in general is such that they invariably follow each other, as it were, in alphabetical order, or as a series of numbers, whatever may be their different denominations. Not that the strata are alike in all the different regions of the earth, either with respect to thickness or quality, for experience shows the contrary; but that the order of the strata in each particular part, how much soever they may differ as to quality, yet follow each other in a regular succession, both as to thickness and quality—insomuch that by knowing the incumbent stratum, together with the arrangement thereof in any particular part of the earth, we come to a perfect knowledge of all the inferior beds, so far as they have been previously discovered in the adjacent country.' (Edit. of 1792, pp. 178, 179.) In p. 186 is the following remark in capitals: 'N.B. No vegetable forms have yet been discovered in any of the limestone strata.'

From these notices it is very clear that a distinct perception of a fixed order in the succession of strata was so prevalent in the mining districts of England as to attract the attention of the well-informed classes of society, and especially of the clergy, who can never with justice be charged with neglect of the natural sciences. But it is extraordinary that Mitchell, who was appointed Woodwardian professor in 1792 (according to Farey), and, by his physical and mathematical knowledge seemed especially able to work out the whole system of English stratification, should, on his retirement from Cambridge to his rectory of Thornhill in Yorkshire, have contented himself with tracing the succession of strata in the north of England, or rather between Cambridge and Thornhill, and communicating the document to Smeaton, without giving it even to the Royal Society, which had published his early papers. Had this been done, or had Smeaton known the value of the paper put into his hands, it could not have happened, that of all the able engineers who, before 1790, were engaged in surveys and executing canals, not a man should have attended to information of such singular value in his profession; nor would Mr. Wm. Smith have been occupied in rediscovering some of the truths which constitute the foundation of English geology.

The progress of Mr. Smith's discoveries in geology is easily traced. Commencing his career as a surveyor of land, and afterwards acquiring great employment as a civil engineer, his attention was drawn, in 1787, to the obvious distinctions in the soils and the subjacent strata of certain parts of Ox-

fordshire and Warwickshire, which occupied, with regard to one another, a certain geographical relation. In 1790 and 1791 the same relative position of the same strata was forced on his attention in Somersetshire, with the addition of a series of coal strata below the oolite, lias, and red marls with which he was previously familiar. Assured by his own observation, that the local knowledge of the mines of Somersetshire which Strachey had published in 1719 was only a part of the truth, he set himself not to frame an hypothesis but to determine the extent of the regular succession of strata in the vicinity of Bath, drew accurate sections of the strata in the order of superposition, ascertained amongst them a general dip to the east, marked their ranges on a map of the surface, and in 1794, in the course of a professional journey from Bath into the north of England, examined impartially whether the general features of stratification in other parts of England corresponded with the impression fixed in his mind by abundant evidence near Bath, that one general order of succession of the strata could be traced throughout the island, with a general dip to the east or south-east. The result confirmed his view, and excited him to devote time, professional income, and unequalled labour to produce proof satisfactory to others. The result was a geological map of England and Wales, drawn previous to 1801, when proposals were issued for the publication of it.

The strong conviction in his mind of the regular, orderly, and successive deposition of the strata, led him to a more minute analysis of the characteristic marks of the several deposits than had ever been conceived before. The remarkable resemblance and occasional proximity of many rocks near Bath, belonging to different places in the section of strata, and which (to use a favourite expression of Mr. Smith), 'had been successively the bed of the sea,' prevented any merely mineral distinction from being effectual; and he was thus forced to study with care the method of distribution of the fossil organic remains in the rocks, for the purpose of discriminating these similar deposits. This was not long pursued before the local peculiarities of the strata in this respect were connected to a general law, and it was found that, throughout the district in question, the fossils were definitely located in the rocks; each stratum had its own peculiar species, wherever it occured, and could thus be identified when in detached masses and in distant localities. This great discovery was recorded as a thing fully determined in a table of the Order of Strata in 1799, of which copies were distributed beyond the British Islands. The clear idea of each stratum being successively the bed of the sea, is apparently the germ of that happy expansion of geological truths, unmixed with hypothesis and unfettered by a formula of merely local stratification, for which English geology is indebted to Mr. Smith. Such an idea immediately suggests, not a speculation in cosmogony, but various yet harmonious researches in the full spirit of inductive science. The history of successive geological periods, all characterizable by their chemical or mechanical products and contemporaneous organic existence, was thus placed in a concentrated light as a general problem for inquiry, and the effects were immediately obvious, in the employment of organic remains, and sections and maps of strata, to determine the true condition of the land and sea from the earliest periods to the present hour.

Succession of Life on the Globe.—Against the hypothesis of Woodward, that the fossil exuviæ in the rocks were lodged in them by the 'universal deluge,' it was objected, that though the fossil shells, corals, fish teeth, &c. resembled the recent kinds, they were not the same. The question thus raised could not rest. Lister affirmed, that in general the fossil species of shells were entirely distinct from living forms; Camerarius inquired to what marine genus of animals Woodward referred the belemnites, and received for reply that it was a mere mineral! The ammonites were admitted to be not nautili, but were declared to be 'Pelagian shells' not likely to be thrown on the present sea-coasts by the moderate force of tides and storms, which do not influence the deep parts of the ocean. Linnæus continually points out the species of corals and shells to which no recent analogue is known; and Solander, by giving suitable names to the extinct shells of Hordwell Cliff, figured by Brander (1766), opened the way to the researches of Martin, Parkinson, Sowerby, Brocchi, Deshayes, Goldfuss, &c.

Llwyd and Scheuchzer commenced the study of fossil plants, which has lately been so much advanced by Sternberg, Adolphe Brongniart, and Lindley. But by none of those writers who compared the fossil and recent worlds of life under the aspects of zoology and botany only could any clear notion be formed of the existence and destruction of a succession of different races of animals and plants. Lister had noticed the constant occurrence of a certain belemnite in the red layers at the base of the chalk; Morton had distinguished the geological position of some fossils in Northamptonshire; and Llwyd and Woodward had some knowledge of this kind. Rouelle and Werner have claims to attention, but certainly it is to Mr. Wm. Smith that we owe the introduction of the important doctrine, that during the formation of the stratified crust of the earth, the races of animals and plants were often and completely changed, so that each stratified rock became, in his eyes, the museum of that age of the world, containing a peculiar suite of organic exuviæ, the remains of the creatures then in existence.

In France the same truth was put in a bright light by the successful labours of Cuvier and Alex. Brongniart in the vicinity of Paris; the former of whom, by his great anatomical skill, succeeded in restoring the vanished forms of many quadrupeds, different from those which now live; while the latter, collecting materials with great judgment from a wide field of research, brought the most convincing proof of the almost total dissimilitude between the forms of life of the secondary and tertiary periods of geology, while both were for the most part distinct from those of the actual land and sea.

The general doctrine of many successive creations of life in the globe, thus firmly established in England and France, was speedily acknowledged in every country where accurate observations could be made, and it only remained to trace out its consequences, and apply them to particular problems. One very successful effort of this kind has been made by M. Deshayes and Mr. Lyell, who, observing among a vast number of the tertiary fossil shells which are different from existing types, some few which are identical with them, proposed to determine what variation there might be in the proportion of yet existing species among the tertiary fossils from different localities and deposits of a different geological age. As a general result (subject to exceptions) it may be stated, that the more recent the strata the greater the amount of resemblance between their fossil contents and the existing creation,—a result in harmony with general views of the whole subject of the analogy of recent and fossil forms. Hence arises a method of classification for these strata of peculiar interest and power, though its successful application may for a time be delayed, till the philosophy of organic remains be more perfectly developed.

Geological Surveys.—Without maps and sections of particular districts, representing the extent, thickness, and order of superposition of the several component rocks, the abstract truths of geology could never become of general interest or public value. Until the whole of the land be thus surveyed and described geological inferences may be insecure; it is therefore gratifying to reflect, that since Mr. Smith first proposed to publish a geological map of England (1801), a considerable part of Europe has been thus delineated. The first idea of such a map was given by Lister in a communication to the Royal Society in 1683; Mitchell's descriptions in 1760 are such as to make it surprising that no map came from his hands. The Wernerian school of geognosy produced none, we believe, so early as those few maps of the Board of Agriculture in England (1794), which contained delineations of soils, and occasionally of the rocks which gave them their distinctive qualities. In this respect Mr. Smith had no precursor; and when his map of the strata of England and Wales was produced in 1815 it had no rival, and has called up only one original successor, the map of Mr. Greenough. Mr. Griffith is about to publish a map of Ireland; Dr. Macculloch's Scotland is produced; Von Buch's great map of Germany is published; the Mining Engineers of France are just completing their survey of that country; the United States of America have made progress in a similar labour; and the number of topographical works illustrated by maps and sections is innumerable. Before many years have passed the whole accessible surface of the land will have been mapped by geologists.

§ 2. Matter of the Globe.

Geology is distinct from cosmogony; the history of the

successive phænomena happening on a planet revolving round an orb of light and heat may be treated without reference to the condition of the same material particles while they were subject to entirely different conditions. Yet as in tracing the progress of a colony reference may often be made with advantage to the previous history of the same people in another region of the globe, so, in prosecuting geological science in a just and liberal sense, it is advisable to take into account the discoveries of collateral science, so far as these tend to give sure indications of or even to fix certain limits to speculations concerning the origin of the planetary masses.

For the successful prosecution of this inquiry geology must appeal to two entirely distinct branches of collateral science, chemistry and astronomy; which indeed agree in this, that they are both directed to the elucidation of the properties of material substance; but the former is occupied with a study of its elementary constitution, the latter contemplates the relations of its congregated masses.

Chemistry, by analysis of the different sorts of matter visible near the surface of the earth, teaches us that almost every thing is of a compound nature, and formed by the union of two or more elementary particles, endowed with distinguishable properties, and capable of a separate existence and of entering into new combinations. When thus freed from their combinations by processes of art the elementary particles or atoms, of the same kind, form, when reunited, solids, liquids, or gaseous expansions, according as they are affected by temperature, pressure, and perhaps other less general influences. Oxygen, the most abundant of all the elementary substances yet discovered, expands immediately on being freed from union with solid bodies, to a gas which occupies 2000 times the space it previously did; and as nearly half the ponderable matter of the globe consists of oxygen, we must admit, as a plain consequence of this analysis, that upon a general resolution of the compound rocks and minerals into their constituent elements, nearly half the weight of the exterior parts of the globe would expand into gas, and augment the atmosphere till the accumulated pressure should liquify the gas, or prevent further decomposition. What happens to free oxygen with the temperatures and atmospheric pressures which now prevail at the surface, would (we know by trial) happen to chlorine and other substances similarly released from combination, under other temperatures and pressures. As these conditions are now variable, and may be supposed to have passed through all possible grades, it is not improbable that all the substances which exist in the crust of the globe might be converted into gaseous expansions if freed from combination. The great antagonist force to the concentration of matter is heat; by augmenting this agent some substances are decomposed and the parts rendered volatile; in other cases combinations take place which are also volatile; and there are others in which gaseous substances combine with solids at particular temperatures only. Now, as the substances known in the outer parts of the globe are fifty-four in number, as they all separately stand in different relations to heat, pressure, electricity, &c., it is conceivable that under particular conditions the mutual forces of the various particles might be so arranged, and so balanced by the influences of heat and other general conditions, that all sensible solidity and liquidity should vanish, and the whole globe dissolve into an expansion where the particles would be, if not all free, yet in very different combinations from those we now see. This is conceivable as an hypothesis, and chemistry can teach us no more; for as we have not ascertained for each substance, taken singly, what must be the conditions for its appearance as a solid, liquid, or gaseous body, nor have the means of computing what variation in this respect might result from particular admixtures of the substances, it is impossible to deny that the hypothesis may be true, and it would be equally unphilosophical to assert that it is. In this dilemma we must turn to the contemplation of phænomena which may serve to guide us to a just decision. Omitting for the present all considerations of geological phænomena, we must accompany the astronomer in his survey of space, in order to discover if any masses of matter exist which are of the nature of the gaseous expansion assumed; if this be the case, we must further inquire if there be gradations in the appearances they present such as to justify the belief in the possibility of a gradual conversion of a planet into an expansion, or the contrary. To these inquiries the far-seeing eyes of Herschel supply a positive answer. Through various parts of the heavens are scattered large expansions of attenuated matter, called nebulæ, which are irregularly reflective of light, various in figure and degree of condensation. The latter circumstances being carefully studied, it appears that many of them are of a globular or elliptical figure, as if the parts were collected by a general attraction toward a centre; that others in addition, appear to grow continually denser toward a centre, while not a few objects show in the centre the brightness of a solid star surrounded by a thick and extensive haze. Occasionally two or more points of condensation appear in a nebulous mass, thus affording a great analogy with what may be supposed to be the origin of our planetary system.

Comets, which are to be regarded as nebulæ attracted to some one or more systems, supply another and strong analogy with orbitual planets. But it may be reasonably expected that in addition to the graduated appearances of expansion, condensation, and nebulous solidity, there should be proof of corresponding gradations of density. This proof, as far as relates to the nebulæ far distant from our system, can perhaps never be given, though appearances are in favour of the view; even with respect to the comets which enter the solar system, further researches must be made; but the planets themselves supply such a proof, for their density varies exceedingly. The planets nearer to the sun are denser than those farther removed; Mercury, being the heaviest, is almost thrice as dense as the earth, while Jupiter, one of the distant orbs, is about one-third as dense as our earth; and Saturn, which, excepting Uranus, is the most remote, is only one-eighth or one-tenth as dense, and may be considered as light as cork. (Herschel, *Introduc. to Astron.*, p. 278.)

Finally, this general idea of the origin of the mass of the earth from a nebular expansion, suggested by chemical facts, and supported by the appearances in the visible heavens, is confirmed by the mathematical researches of Laplace, who has by this supposition connected together the most striking phænomena of the solar system; the general parallelism of the orbits of the planets, the consentaneous direction of their movement round the sun, of the satellites round the planets, the anomaly of Saturn's ring, and other important circumstances. We have therefore only one test more to which the hypothesis can be subjected, namely, its accordance with what is known of the actual constitution of the earth. This is still no question of geology, but of astronomy. It appears however very certain that neither the figure of the earth, which is that of a spheroid of revolution on its axis, nor the density of the earth, which is greater toward the centre than at the circumference, and so arranged that the surfaces of equal density are symmetrical to the axis of figure, are at all opposed to the doctrine in question, but rather confirm it. From astronomical and chemical considerations, then, it is probable that the mass of the earth once existed as a part of a diffused nebula, like some now visible in the heavens; and as no merely geological evidence as to the changes operated on the condensed planet can be of the smallest value in a question relating to the condensation of a nebula, we must adopt the conclusion as a limiting condition of geological theory.

Consult for further information the article NEBULÆ; Herschel's *Introduction to Astronomy*; Laplace, *Mécanique Céleste*; Nichols's *Architecture of the Heavens*.)

Uniformity of Natural Agencies.—But however firmly we may admit the truth of the speculation of the condensation of planets from a nebular expansion, it can now have but little influence on the progress of geology. For it cannot be employed as the origin of deductions which might disclose circumstances hidden from observation in deep parts of the earth, and explain complicated facts visible at the surface; and this for want of adequate knowledge of the successive effects which must happen among the elementary particles or masses of a nebula during its condensation, as well as of the necessary consequences which such effects must entail on the physical conditions of a planet.

There is however one point of importance which this speculation, if adopted, may assure us of. The condensation of nebulæ is gradual; the density of planets various, the larger ones in general having the least relative weight; the earth must therefore be supposed to have passed through a long range of condensation; and this implies a continual change of intensity among some at least of the physical agencies which belong to it. Whatever was the antagonist

force to the central attraction of the nebular mass, the gradual decline of this force must have been felt, more or less, by all the natural agencies related to it by opposition or sympathy. Even the extraneous influence of light is not independent of the change of conditions produced.

The continual condensation of the mass of a planet necessarily brings with it a change in the relative intensities of the agencies at work among its parts, because they operate under continually varying conditions. Some would lose and others gain in strength, and thus the aspect of the earth must have been continually changing, or subject to periodical renovation. By those geologists who accept the doctrine of the earth's continual condensation, from whatever cause, the uniform intensity of natural agencies taken separately, the continual compensation of their antagonistic effects, and the production of equal effects in equal times, must inevitably be rejected.

Yet though, in strictness, the preceding reasoning forbids assent to Mr. Lyell's general principle, that the former changes of the earth's surface 'are referrible to causes now in operation,' it by no means follows that other causes (that is, other combinations or measures of natural agencies) than those now in operation must be appealed to for explaining the monuments of past revolutions of nature which are preserved to our days. For if these monuments go but a short way back on the scale of time, compared with the periods which elapsed in the condensation of our planet, the causes may not have sensibly varied during the whole course of phænomena traceable in the crust of the earth. This must be decided by a study of the monuments themselves, upon the general and acknowledged principle, that effects are proportional to the causes. Still less is it to be imagined that the study of the effects of modern causes in action is unfruitful in illustrations of the phænomena due to antient causes; on the contrary, there is no other way of learning either the kind or degree of physical agencies concerned in geological operations of early date than the comparison of these with the results of the daily action of the modern powers of nature.

§ 3. Heat of the Globe.

The knowledge of the condition of the earth in respect to temperature is one of the most important steps which can be taken toward a right general contemplation of the history of the revolutions which it has undergone. This knowledge cannot be gathered by geologists labouring as such; it cannot be obtained by meteorological observations, however accurate; nothing short of a mathematical theory of heat, supported by a variety of data concerning the physical constitution and relations of the earth to the sun and space, will be at all available in grappling with the inherent difficulties of the subject. For this theory we are indebted to Fourier.

The heat of any point on the surface of the earth regularly varies from hour to hour, with the rotation of the globular mass on its axis; from day to day and from season to season, with its revolution round the sun; and from year to year to year, with any change in the dimensions or form of the earth's orbit. There are however several causes of irregularity or fluctuation of temperature not demanding notice in a general view.

If in its long course round the sun, the earth passed through parts of the planetary spaces of unequal temperature, this would cause a modification of the periodical, annual, and daily variations.

The atmosphere and the ocean, by their various movements, modify all these circumstances, but not so as to disguise the results when an average of many periods is taken.

In consequence there is for each point of the earth's surface a certain mean temperature, depending on the causes above stated; and the parts under the surface continually tend to acquire very nearly the same temperature as the surface, but not at the same time. The extremes of summer heat and winter cold are not felt till after they have passed away from the surface, and in proportion as we descend, the influence of the daily, monthly, and annual variations grows less and less, because of the slowness of the conduction of heat through earthy substances.

At a certain depth below the surface, these variations become wholly insensible, and the temperature is constant, and nearly the same as the mean temperature of the surface.

If the temperature of the interior parts of the earth be now very different from that constant heat which would result by communication from the surface (heated as before, and subject to the stated variations), this difference would exercise a corresponding though insensible effect on the surface heat, and be more or less sensible at small depths below the inner surface of constant temperature.

Whatever may have been the proper or original temperature of the inner parts of the earth, it is easy to conceive that in very long time the equilibrium of heat should be reached, and the earth receive from the sun and radiate into the ethereal space equal quantities of heat in equal times; while the temperatures at points situated at very great depths below the surface (many miles, for instance) would not sensibly vary from that of the mean heat of the place vertically above them.

But if this equilibrium be not attained, the original state of the earth as to heat may be ascertained, so far as to determine positively whether it has formerly been hotter or colder than at present, by merely trying at many points exempt from volcanic action, what is the amount of heat at various depths, on the same or different vertical lines, as compared with the corresponding points of surface.

These trials have been made at various depths, under different circumstances, in salt-pits, coal-works, and mines of different metals, in the British Isles, France, Germany, Mexico; and in all situations where the external influence of the air, and the artificial effects of light, respiration, &c., could be guarded against or justly appreciated, they agree in proving that after descending below the limit of variable heat, a continual augmentation of temperature constantly occurs. (1° Fahr. for 15 yards is a common ratio.) The mine of Falun, supposed to be an exception to this general truth, is extremely ill-suited for experiments. (See Thomson's and Clarke's *Travels in Sweden*.)

The consequence is obvious. The interior masses of the globe are incomparably hotter than the parts at the surface; must formerly have been still hotter; and though now the interior heat is almost wholly masked and stifled by the non-conducting stratified masses which form the crust of the earth, it must formerly have influenced in a decided manner the temperature, and with it all other phænomena at the surface of the earth.

The same conclusion as to the existence of great heat in the central parts of the earth has been drawn from considerations of the density of the interior masses, as compared to the superficial parts. While the surface rocks are twice and a half as heavy as water, the mean density of the whole globe is five times as great as that of water; moreover the density augments toward the centre with so much of regularity, that the imaginary interior surfaces of equal density are symmetrical to the same centre and axis as those of the exterior spheroid. (See Conybeare's *Report on Geology to British Association*, 1832.) Now if the interior masses of the earth are compressible even to a far less extent than the rocks near the earth's surface, the pressure to the centre would have made the inner parts much more dense than they are: the whole mass of the earth would have been included in a much smaller volume, were it not for some antagonist force, such as heat is known to be. Unless therefore we venture to suppose the central and surface matter not subject to similar laws of force, it must be admitted that the interior parts of the earth are still very hot.

Condition of the Interior Masses.—This great truth established, we may inquire further into the state of the interior masses. If the heat of the globe were increased, its diameter would be augmented; there is a degree of heat which would liquefy nearly all the substances of which it consists, taken singly, and still more easily when in their usual combinations. Beyond this degree of heat gaseous compounds would mix with, or altogether replace, the liquid rocks, and the globe would be lost in a nebulous expansion.

Turning to observation of phænomena, we find the interior rocks to be such as were cooled from igneous fusion: they are extensively, perhaps universally, spread below our feet; and thus we gather the conviction that originally the whole or great part of the exterior masses of the planet were in a melted state. The figure of the earth is such as would result from revolution on its axis, provided the whole or a very large part of the mass were in a state of fluidity or viscidity; to this figure the surfaces of equal density correspond both as to centre and axis; and thus strongly corroborate the speculations of Leibnitz, that the earth is to be

looked on as a heated and fluid globe, cooled and still cooling at the surface by radiation of its superabundant heat into space.

Refrigeration of a Planet.—To determine whether it is now solid or partially fluid within is a problem of high interest, and one which we may perhaps despair to see completely solved, unless certain astronomical phænomena (precession, nutation) should be found, when analyzed by a rigorous mathematical deduction, to furnish interpretations which geology alone can never attain to. As however Mr. Hopkins, who is engaged in this abstruse research, has presented some simple views of the possible conditions of a cooling globe (as the earth may be considered), we shall here briefly state them.

If the earth were originally a hot fluid mass cooled by radiation, the cooled parts would descend towards the centre, and be replaced by others in a perpetual circulation. The tendency to solidification in such a mass would be directly as the pressure, inversely as the temperature, both which are at a maximum at the centre: solidification would therefore be determined near the centre by the superiority of pressure over temperature; and at the surface by the rapidity of external refrigeration overbalancing the internal conduction of heat. The numerical relations of these qualities are unknown. It cannot therefore be decided by mere calculation whether the solidification of the surface by radiation would precede or follow that of the centre by pressure. Let us suppose, for simplicity, the relations of pressure, heat, circulation, conduction, and radiation, to be such that all the mass goes on cooling till in every part of its fluidity is lost, and the whole is reduced to such a degree of viscidity as to prevent the circulation of heated matter, the further distribution of heat must, under these conditions, be determined by conduction and radiation only; a large part of the interior would assume equality of temperature: the solidification of the surface by cooling would be the first new phænomenon, to be immediately followed by condensation through pressure about the centre; and thus two solid masses would be produced and continually augmented—a spherical nucleus, and a spherical shell—while between them would remain a large but diminishing zone of viscous matter, subject to some changes of temperature through the conversion of its surfaces from a liquid to a solid state.

If, on the other hand, the effect of pressure to the centre became superior to the expanding agency of heat, before the circulation of liquid matter had ceased in the superficial parts, the centre would solidify first; and the induration might proceed through a large part of the globe, so as even to approach the surface before that could be consolidated. If these conditions were reversed, consolidation might proceed from the surface downwards, and would ultimately reach the centre, and the whole mass be a stony globe.

It is important to remark that upon neither of these suppositions is it required to admit the continual augmentation of heat to the centre; to which M. Poisson objected, and instead of which he proposed to account for the phænomena of the earth's interior temperature by supposing that the solar system had once passed through other ethereal spaces than those which it now occupies, and there experienced much higher temperature at the surfaces of the planets. This hypothesis may be perhaps not very different in its development from the more general theory of the nebulous origin of the planets; but it appears unnecessary to discuss the speculation after what has been said of the cooling of the earth.

§ 4. Modern causes of Changes on the Surface of the Earth.

The never-ceasing activity of the powers of nature may be viewed as an inextinguishable and unavailing effort to restore an equilibrium which is incessantly disturbed. The protean changes of the atmosphere; the varying effects which its chemical and mechanical energies occasion among the masses of dead matter and the forms of life; the flowing of the ocean; the subterranean fire and wide wasting of the earthquake, are all efforts to obtain rest consequent on a succession of perturbations. In this sense, not the earth only, but all the solar system, and perhaps all the extent of the heavenly spaces, conceivable rather than visible by man, is in the condition of instability described in the Pythagorean Philosophy, 'Nihil est toto quod perstet in orbe.'

These changes on the surface of the earth affect the geographical boundaries of land and water, the relative levels of land and sea, and the forms, proportions, and distribution of animal and vegetable life. In a popular sense they may be classed by their proximate agencies, as depending on chemical and mechanical powers originating from atmospheric action, rains, springs, rivers, &c.; as depending on similar powers residing in the ocean; and as affected by volcanic forces. We may also venture to contrast the effects of the watery agencies, whether of atmospheric or oceanic origin, with the products of volcanic fires. For the general effect of the watery agencies is to abate the high and to raise the low, to equalise the level of land and sea by abrading the former and filling the latter; but volcanic effects are directly the reverse. They augment the original inequality of the surface; in some parts they raise matter from within the earth, and form new hills to bear the ravages of the atmosphere; and elsewhere cause tremendous depressions of land, and sink in deeper hollows the original basins of the ocean.

The external influences, thus contrasted with the interior powers of the globe, are far more various in their aspect and more general in their visible operation; yet they may all be reduced to one or two variable forces, independent of the terraqueous system. It is to the unequal accession of heat from the sun, upon a globe whose distance varies, whose parts are variously presented to the radiating beams, and to the unequal abstraction of heat by the cold ethereal spaces in which the earth circulates, that we may refer all the variations of corpuscular and mechanical phænomena on the globe; while in the varying diffusion of light we recognise the prime element of change in the animal and vegetable world.

Minute as is their momentary impression, the sum of their effects in a long time is prodigiously great; heat and moisture by alternate influence weaken; frost bursts; carbonic acid eats with cankering tooth; rains, swallowed up by the fissured rocks, abstract parts of their substance; landslips, avalanches, and glaciers heap the valleys with detritus, till swollen rivers or bursting lakes sweep away the burden towards lower ground, or convey it even to the sea. Thus chemically dissolved, mechanically suspended, or roughly rolled along, the substance of all the rocks and mountains yields to a slow but sure destruction, and those who, adopting the notion that 'time costs nature nothing,' take as much of this as pleases them, may easily see, in the effect of these operations, the total disintegration of the existing continents and islands, which is so conspicuous a feature in Dr. Hutton's hypothesis of the decaying and renewing earth.

Nor is the sea less a theatre of change than the land. For, independent of its receiving the spoils of the land, and distributing them on its bed, the untiring agitation of its waves undermines the cliffs which are above its level, grinds away the rocks which are covered and uncovered by the tides, and distributes the materials in various ways, here making dangerous sandbanks, there adding to the low shores a valuable heritage.

Nor even below the deep water of the middle ocean is all at rest. There multitudes of sea animals, the zoophyta, testacea, &c., by their mere exuviæ tend to fill up the depths; and certain tribes (the lamelliferous corals in particular), by their peculiar growth and mutual adherence form calcareous islands and reefs, similar in some important particulars to the antient limestone rocks. These coralligenous rocks are however not reared from the extreme depths of the sea, but based on the summits of submarine hills, or the crests of volcanic cones, and thus, in a general expression, we may say that in modern nature most of the deposits of solid matter in the sea are joined to the shores or shallows of the previously-formed land.*

The sediments transported by rivers, and gathered by the wasting of the elevated coasts, being for the most part deposited along the sea-shores, and almost wholly below the level of high water, it is obvious that from this cause alone the bed of the sea is filling up, and its depth diminishing toward the shores; but as the quantity of water on the globe must be supposed sensibly constant, it follows that the oceanic area must expand, or its surface rise a little. But since the land is wasted by the waves, as we may suppose the augmentation of area which results from this cause sufficient to balance the elevating tendency of the littoral deposits of sediment, and that upon the whole the effect of the watery agencies on

* For details in proof of what is here advanced, consult Lyell, 'Principles of Geology,' and the articles Polyparia, River, &c.

the globe is insensible in altering the level of the surface of the sea, as compared to the deeper parts of its bed; it follows, as a strict consequence, that the area of the ocean is enlarging. This appears also probable from observation; for the small addition of marsh land on particular shores, by the influence of rivers, winds, and storms, in raising littoral sediments above the reach of all but the extremely high tide, is not enough to balance the continual waste of land along many thousand miles of perishing cliffs. By the mechanical agency of water considered alone, the land is certainly losing in area continually. The accumulation of marine exuviæ on the bed of the sea acts in the same direction, and the growth of coral principally concurs in the same result. Left to watery agency alone then the land may be imagined to be continually diminishing, as Dr. Hutton and Mr. Lyell suppose. If the shores of the sea did not waste away, the annual additions of sediment brought from the uplands would everywhere cause the water to rise in level; if the land were supposed to overhang its base at a certain angle depending on the diameter of the earth, the area of the ocean would remain invariable; but as neither of these conditions applies, it is certain that the area of the ocean is extending, and probable that its level does not materially change.

Volcanic phænomena, the earthquake and the ignivomous mountain, are to be viewed as cases of critical action. Whether the heat of the interior of the globe be the residual portion of its original temperature (*chaleur d'origine* of Arago), or generated by the access of water, or other bodies containing oxygen, to certain chemical substances, it is to the disturbance of its equilibrium that the violence and the tumult of volcanic excitement are owing. But there are other and more gradual effects of the distribution of heat in and upon the globe which require notice. The most important of these is the gradual change of level of certain parts of the land, as compared with the general level of the ocean, one instance of which is supposed to occur on the shores of the Baltic, where certain tracts appear to be slowly rising above the sea. (Lyell, in *Phil. Transactions*, 1835.)

Concerning this 'secular inequality,' (as it may be termed) of level of land and sea, it is unfortunate that nothing at all important is known toward determining the important question whether the elevation of one tract of dry land or sea-bed is balanced or overbalanced by the depression of another. Mr. Lyell assumes that the depression of land from this cause exceeds the elevation, but it is difficult to find sufficient evidence for this important postulate; and to adopt it merely as a consequence of another unproved assumption of a continual compensation of the agencies of nature, is altogether inadmissible.

If there be in the earth a pervading high temperature, which diminishes from the interior toward the surface, in consequence of the radiation from the surface, it appears from Sir John Herschel's reasoning (given in Mr. Babbage's 'Ninth Bridgwater Treatise'), that along the shores of the sea the isothermal lines of the interior of the globe should rise, because of the continual deposition of imperfectly conducting sediments there. For thus the radiation of heat along these lines would be diminished until the interior heat had come nearer to the surface. By the consequent expansion of the subjacent earthy substances the sea-shore should rise, and thus the addition of sediment from watery action, and the effect of the effort to restore equilibrium in the disposition of the interior temperature, would, upon the whole, coincide in minutely raising the surface of the sea.

It is chiefly near the sea-coast, on the land or in the ocean, that volcanic phænomena are at this day seen in activity, and this apparently because the admission of water to some depth below the surface is necessary to the excitement of the imprisoned forces of heat. The elevated cones and large areas of melted rock, or accumulations of scoriæ and ashes, mark one of the prevalent effects of the volcanic forces to be the withdrawal of matter from the interior, to heap it on the surface of the earth. But the cavities left by this operation below the crust of the earth must often cause depression of masses of land during the concussion and displacements occasioned by earthquakes. In this manner it may easily be understood that the volcanic islands of the South Seas have been raised up from the sea-bed there, and it may be supposed that under large tracts of the ocean volcanic agency is employed in a similar way, and by a superiority of elevation over depression, raising irregularly the bed of the sea, and by consequence extending the area of its surface. If all the cavities left below the surface by the heaping of volcanic matter on the land were completely balanced by corresponding depressions of the crust of the earth, it would depend upon the proportion of submarine subsidence corresponding to terrestrial elevation whether the sea-level should fall, and its area contract. Every sinking of the sea-bed corresponding to an elevation of the dry land would tend to lower the level of water, and to augment the area of land. Along sea-coasts such correspondence must be admitted occasionally to occur. If the cavities alluded to were not compensated by the sinking of the superincumbent crust, volcanic phænomena on the land would hardly affect the area or level of the sea; but similar eruptions in the sea would raise its level and cause it to encroach upon the land. If it be admitted as the most probable basis of reasoning, whether subterranean cavities exist or not, that the continual elevation is upon the whole balanced by continual subsidence, submarine and continental volcanic vents may be left out of consideration; but the littoral and insular volcanoes act in one certain way, and give as the general result of all volcanic action, a partial deepening and a general contraction of the sea, which counterbalances in kind the general effect of the aqueous agencies; but whether these completely antagonist principles are equal in degree can not be safely inferred from any data now accessible to geology. Nor does it appear prudent to rest so important a conclusion on the mere fact of the constancy of the earth's dimensions, indicated by the invariable length of the solar day; the experience of 2000 years is as nothing in a question of such infinitesimal differences of diameter as might be occasioned by changes in the relative position of the really small quantities of matter raised or sunk by volcanic powers.

Moreover it is impossible to avoid doubting whether even the quantity of water on the globe is constant; for so many combinations of earthy substances require certain proportions of water for their completion, and so much of volcanic excitement appears due to the decomposition of water, that it would perhaps be safer to suppose the water continually diminishing in quantity; nor is it at all unlikely that such may be the case with the atmosphere.

§ 5. Comparison of Effects of Natural Agencies in Modern and Antient Times.

The statement of the effects of modern causes must necessarily be received as true and applicable to other æras of the world, at least in its general features; because the chemical, mechanical, and vital forces of nature are admitted as individually constant, though their manifestations to our senses be ever so various in kind or degree, in consequence of change in their combinations, the quantities of matter operated on, external influences, &c. Fixed laws and variable conditions are certainly recognised in existing nature, and they give rise to extreme inequality in local results and combinations. It is conceivable, by extending this idea, that the existing laws of nature should be productive not only of results which, taken locally or periodically, appear unequal in degree or diverse in kind, but that under the influence of a general change of conditions they should manifest a gradual decay or increase of strength, or spring into extraordinary activity after long periods of apparent slumber. Let, for instance, the sun's rays be supposed to fall upon the earth in smaller quantity through the augmentation of the minor axis of the earth's elliptic orbit; let the temperature of the ethereal spaces rise: who does not see that all the effects depending on the external excitant forces would immediately change? In like manner, let the earth's internal energy of heat be supposed to die away, whether for lack of fuel, incrustation over metalloids, or a loss of general warmth in the globe, the volcanic phænomena would be weakened, and no longer balance the effects of water.

Now as these great conditions cannot be affirmed to be constant, but, on the contrary, as one at least of them is known to be variable (the earth's orbit), how 'baseless as the fabric of a vision' is the assumption that the physical agencies on the globe have always produced 'equal effects in equal times,' and that modern causes acting with their present intensity have produced all the older phænomena of geology. But it would be equally unjust, as observed before, to assume that they have not; the question, if capable of determination, can only be settled by ample observation and logical induction.

Among the antient phænomena of nature we equally recognise the contrasted action of water and heat, as at this day: by the former the solid land was wasted, and stratified rocks were deposited along the sea-shores (as sandstones) and in the depths of the sea (as some limestones), while the latter manifested itself in the production of unstratified crystalline rocks and the elevation and disruption of the stratified bed of the sea. [ROCKS; STRATIFICATION.] The materials arranged by the action of water in the stratified rocks of antient date are the same as those now carried by rains, suspended by the tide, or separated from sea-water by the vital functions of invertebrata; they are, to a certain extent, similarly associated: the organic exuviæ buried in them are not very differently arranged or grouped from those which now lie in the bed of the sea (Donati's *Researches on the Bed of the Adriatic* may be quoted in proof of this); the physical conditions of their accumulation were therefore in a considerable degree similar.

On a careful consideration of the facts, it appears obvious that the long series of stratified deposits was not accumulated without great and even sudden changes of those physical conditions: thick deposits of sandstone are followed by others of clay or of limestone, for which different agencies and conditions were required. Over the same spherical area of the earth's surface the predominant physical conditions varied from time to time, and many times, so that the actual state of the globe, as far as regards watery agencies, represents not all its previous conditions, but is to be compared with each of them successively. The same is true of the igneous products in the crust of the globe, which similarly varied from time to time in the same spherical area.

Successive phases of the aqueous and igneous agencies over the same region appear, either contemporaneously or successively, to have affected all parts of the earth's surface accessible to man; so that everywhere there is proof of great revolutions in the condition of land and sea. Moreover it appears [ORGANIC REMAINS] that to each general system of stratified rocks, indicative of a corresponding great system of physical agencies, peculiar races of plants and animals belong:—with new physical conditions, new forms of life came on the globe, vanished with those conditions, and gave place to others equally transitory. If now we compare the modern survey of nature with any similar work, executed on the same principle, for any one of the earlier epochs, it is certain that the earth has undergone many very extensive revolutions in all that respects its aqueous, igneous, and organic phænomena, before arriving at its present state: it is equally certain that between the epochs of these revolutions, the state of the earth was not extremely dissimilar to that which we now behold; yet, because the organic beings preserved in the earth in each of these systems are peculiar to it and differ from the others, and from those that now live, we cannot possibly doubt that the points of difference were numerous, general, and important.

To determine the cause of the change of physical conditions between one system of stratified rocks and another is not difficult. In existing nature such a change might be easily produced in almost every region by a disturbance of the level of some particular tracts of land, by one great movement or many successive displacements. For example, let the isthmus of Suez or the isthmus of Darien sink one hundred or a few hundred feet (perhaps scarcely beyond the range of the power of an earthquake), what mighty changes would be occasioned in the Indian, Mediterranean, Atlantic, and Pacific Oceans, over areas which would appear considerable even when compared with many antient systems of strata—changes of stratified deposits, and physical conditions, and consequent variations in the relative abundance and geographical distribution of organic beings. Now, though at this day no such mighty changes are witnessed, we have only to enlarge our conception of the actual effects of volcanic agency to see clearly that this is the power which was employed in producing them.

§ 6.—SURVEY OF SUCCESSIVE PERIODS OF THE FORMATION OF THE CRUST OF THE EARTH.

The analogy of the effects of aqueous and igneous agencies in all past periods of the earth's history being assumed, we may proceed to gather inferences as to the measure of the intensity with which they have operated, and the time which has elapsed during their operation. This requires at least a brief summary of the characteristic features of the phænomena of successive steps of the earth's formation, in the order of their occurrence. Observation can only guide us to a knowledge of the crust of the earth for a depth of a few miles at most; and from what we there behold it is probable that a much greater extension of the power of observing would really help us but little in tracing the history of the revolutions of our globe of which monuments remain for inspection. For at some moderate depth below the surface all marks of lamellar increase, indicative of periodical formation, cease; all monuments of life and watery action terminate; and we behold the effects of heat alone. The general basis of all the crust of the earth, in which we trace the combined results of igneous, aqueous, and vital energies, is a mass of crystallized rocks, the fruit of great and very general heat; which limits all inquiry in that direction.

From the surface of these interior crystalline rocks mostly of the nature of granite [ROCKS; STRATIFICATION], the monuments of physical changes left in the rocks are capable of interpretation by the application of the knowledge we have gathered of chemical, mechanical, and vital forces, but below it all appears at first sight dubious and dark. Were these rocks of igneous origin anterior to the whole crust of the earth now placed upon them? Or does the interior heat slowly reconvert to granite the masses of sedimentary strata laid upon it by external watery agencies? In the former case the monuments of nature are complete so far as any thing analogous to the present system of surface agencies is concerned; but according to the latter supposition, the earlier strata, with whatever of organic exuviæ lay in them, have been reabsorbed and melted into the hidden secrets of the earth, and a similar fate awaits their successors.

To assume the truth of either of those views is altogether contrary to the prudent spirit of modern philosophy: no inspection or analysis of the old granitic masses; no merely analogical comparisons of them with the fluid compounds of existing volcanoes; no *à priori* reasoning will solve the question. Yet it appears capable of solution by a full and impartial consideration of the stratified crust of the earth itself, which ought to show, in the nature and condition of the lower strata as compared with the upper, and in the nature and abundance and mode of conservation of organic remains, evidence not only of the circumstances under which they were accumulated, but indications of the nature and extent of the changes which have since occurred to them. This mode of inquiry we shall endeavour to follow.

This first diagram on the following page is intended to show how very small is the supposed depth of the crust of the earth, and of the most profound parts of the ocean, compared to the radius of the globe. The thickness of the crust of the earth, here taken at 15 miles, is perhaps, on a general average, not so much as five. To this mere film on the surface of the globe inductive geology is confined; though by help of collateral science we have learned many truths as to the constitution of the hidden interior masses.

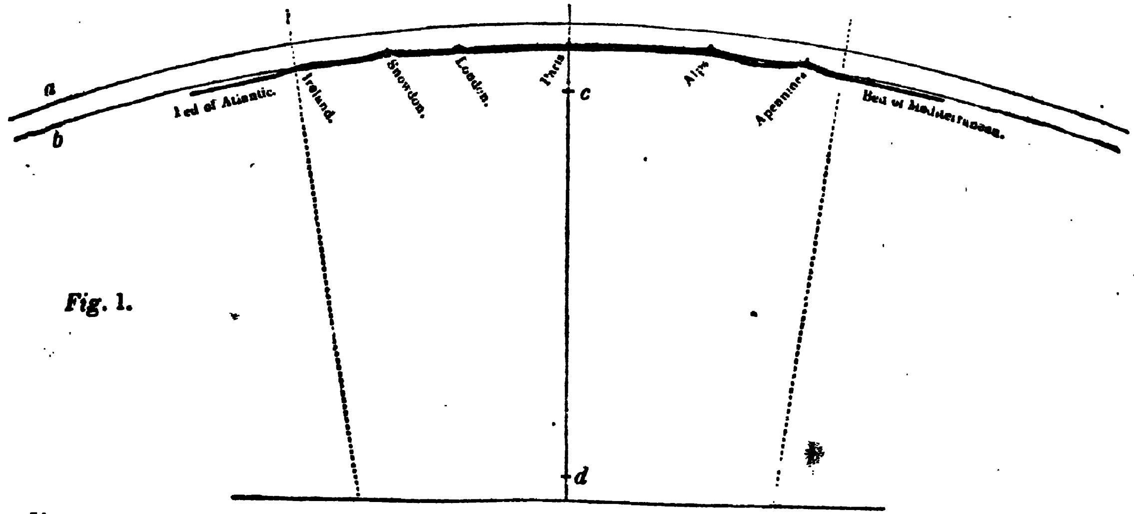
The difference of the diameters of the earth is nearly 26 miles. If the axis of the globe were displaced 90°, the level of the sea would rise at the old poles and sink at the new poles about half that quantity, or 13½ miles; and at other points, intermediate quantities, according to their relations to the great circle passing through the new and old poles of rotation. At the poles of this great circle there would be no alteration of level.

By imagining the depth of 1000 miles, in the first diagram on the following page, to be repeated three times, and the three radii to be at the same time prolonged till they meet at a point, which would represent the centre of the earth, the reader will easily form a notion of what is intended.

The arc includes 20 degrees from the Adriatic to the Atlantic, passing over the Apennines, the Alps, the English Channel, the Welsh Mountains, and the Irish Sea, the depth of the narrow seas being less than the breadth of the fine lines.

The subjoined general section (*fig.* 3), combined with the complete table of British strata which follows (extracted from Phillips's 'Guide to Geology,' 3rd edition, p. 19) will serve for reference to the reader who may be unacquainted with the arrangement of the stratified rocks in the crust of the earth.

Fig. 1.



a, Line representing the supposed limits of the atmosphere, 45 miles above the earth. *b*, level of the sea. *c*, depth of 100 miles on the radius; the black part being the supposed thickness of the earth's crust. *d*, depth of 1000 miles.

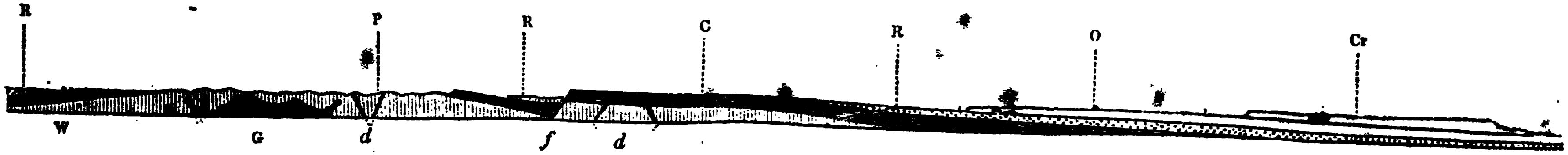


Fig. 2. A general section of the crust of the globe, about 100 miles in length and one mile in depth, from Bridlington, B, to Whitehaven, W, on a true scale, that is, the height proportioned to the distances.

G, the granite, appearing under the slaty primary rocks, P, of Cumberland, which rise to the height of 3160 feet. C, the carboniferous system, rising to the height of 2901 feet in Crossfell. R, the red sandstone, or saliferous system, usually found in very low ground. O, the oolitic system, rising to 1485 feet in the Hambleton hills. Cr, the cretaceous system, which, at its highest point in the York Wolds, is 805 feet above the sea. *d*, dykes of basaltic or porphyritic rock. *f*, a great dislocation.

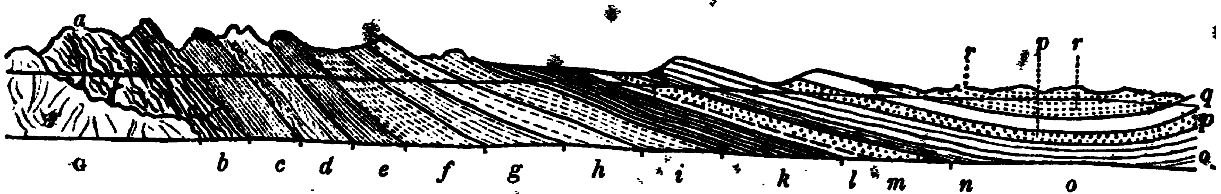


Fig. 3. General view of the succession of British strata, with the elevations they reach above the level of the sea.

G, Granitic rocks; *a*, gneiss; *b*, mica schist; *c*, Skiddaw or Cumbrian slates; *d*, Snowdon rocks; *e*, Plynlymmon rocks; *f*, Silurian rocks; *g*, old red sandstone; *h*, carboniferous limestone; *i*, millstone grit; *k*, coal-measures; *l*, magnesian limestone; *m*, new red sandstone; *n*, lias; *o*, lower, middle, and upper oolite; *p*, greensand; *q*, chalk; *r*, the tertiary strata.

Series of British Strata, beginning at the Surface, from which all Water-moved Gravel and River Sediments are supposed to be removed.

[The Marine Strata are marked by Figures; the Fresh-water and Æstuary Beds by Letters; the names of some characteristic Fossils are in Italics.]

TERTIARY STRATA.

A small number of the Fossils are identical with existing species.

Names of Formations.	*General Thickness. Yards.*	*Remarks.*
1. Clay	16	A water-drifted mass of marine shells, pebbles, &c., resting on more regular shelly beds of sand or sandy limestone. About 40 per cent. of the shells are supposed to be identical with existing species.
a. Fresh-water marls	33	They include a bed of æstuary shells, and occur only in the Isle of Wight.
2. London clay	100 to 200	Mass of clay rich in marine shells, of which 3½ per cent. are identical with recent kinds.
2. Plastic clay	100 to 400	Variously coloured sands and clays, the latter containing organic remains identical with or much allied to those of the London clay.

SECONDARY STRATA.

All the Fossils belong to extinct species. They are different from those in the Tertiary Strata.

System	*Names of Formations.*	*General Thickness. Yards.*	*Remarks.*
Cretaceous System.	3. Chalk	200	Of unequal hardness, soft above, marly below, with interstratified flints; extinct Zoophyta, *Ananchytes*, and other Echinodermata.
Cretaceous System.	4. Green sand	160	Upper green sand, very fossilliferous, in general chalky. Gault, a blue marl, or clay, often very fossilliferous. *Belemnites minimus*. Lower green sand, or iron sand, very fossilliferous in places.
Oolitic System.	*b.* Wealden	300	Weald clay, with fresh-water shells. *Cyprides*. Hastings sands, with land plants, and bones of *Iguanodon*. Purbeck beds of clay and limestone, with fresh-water shells.
Oolitic System.	5. Portland oolite	130	A variable locally oolitic limestone; some beds full of fossils. Kimmeridge clay, with layers of *Ostrea deltoidea*.
Oolitic System.	6. Oxford oolite	150	Upper calcareous grit. Coralline oolite, with beds and masses of coral; *Echinida*; many shells. Lower calcareous grit. *Ammonites catena, Pinna lanceolata*. Oxford clay. Kellaway rock. } *Ammonites Calloviensis, Gryphæa dilatata*.
Oolitic System.	7. Bath oolite (near Bath)	130	Cornbrash, thin, impure, shelly limestone. *Avicula echinata*. Forest marble. Shelly oolite, with concretionary sandy limestone. Bath oolite. In several divisions, shelly, oolitic, compact, and sandy beds. *Megalosaurus, Apiocrinus*. Fuller's earth. A series of calcareous and argillaceous shelly beds. Inferior oolite. Pholadomya. *Trigonia striata*. Sand, with concretionary masses holding shells.
Oolitic System.	8. Lias	350	Upper lias shale. Full of characteristic saurians, of *Ammonites, Belemnites*, and other shells. Marlstone, replete with *Terebratula*, Pectinida, *Avicula inæquivalvis*. Middle lias shale. Contains *Gryphæa, Ammonites*. Lias limestone, with *Gryphæa incurva, Ammonites Conybeari*. Lower lias shale, and coloured marls.
Saliferous, or New Red Sandstone System.	9. New red sandstone	300	Coloured marls, gypsum, and rock salt. Red and white sandstones, and marls. Conglomerate and sandstone. } Few or no organic remains.
Saliferous, or New Red Sandstone System.	10. Magnesian limestone	100	Knottingley limestone. A few bivalves in the lower beds. Gypseous red marls. No fossils. Magnesian limestone. Shells, corals. Marl slate. *Fishes* of remarkable forms. Red sandstone. Plants of the subjacent coal series occur in it.
Carboniferous System.	*c.* Coal	1000	The subdivisions of the coal series are only locally ascertained. Gritstone and shales constitute the principal mass. Flagstone and ironstone are among the most characteristic layers. Freshwater limestone and marine limestone are exceedingly rare and local. The shells are mostly of æstuary origin. The plants are mostly of terrestrial tribes and extinct genera.
Carboniferous System.	11. Carboniferous or mountain limestone	800	Millstone grit, series of sandstone, shales, coal, and thin limestones, forming a transition group between the coal and the carboniferous limestones. Yoredale rocks, consisting of five or more beds of limestone, with alternating flagstones, and other gritstones, shales, thin coal, ironstone. Lower or scar limestone, in the North of England and Scotland, subdivided by sandstones, shales, and coal seams. They yield characteristic *Crinoidea, Productæ, Spiriferæ, Orthocerata, Bellerophon, Goniatites*. Alternating limestones and red sandstones, forming a transition group between the carboniferous limestone and red sandstone formations.
Carboniferous System.	12. Old red sandstone	100 to 3300	Conglomerates and sandstones. No fossils yet noticed. Coloured marls and concretionary limestones, called "cornstones." A few fossils. Tilestones, or flagstone beds. A few fishes.

See, on the subject of this classification of the Carboniferous System, the second volume of the 'Geology of Yorkshire,' 1836.

PRIMARY STRATA.

All the fossils belong to extinct species, and often to extinct genera and families. They are different from those in the Secondary and Tertiary strata. It has been usual to class the upper systems under the title of Transition strata, and to confine the name of Primary to the mica schist and gneiss systems. The following view of the subject results from Mr. Murchison's researches:—

System	*Names of Formations.*	*General Thickness. Yards.*	*Remarks.*
Silurian, Upper Grauwacke, or Transition System.	13. Ludlow rocks	660	Sandstones. Species of *Orbicula, Lingula*, Terebratula, Spirifera. Limestone. *Pentamerus, Homonolotus*. Shale.
Silurian, Upper Grauwacke, or Transition System.	14. Wenlock limestone	600	Limestone. Shale. { Corals and Crinoidea in vast abundance. *Euomphali, Producta depressa*, Orthocerata, *Calymene Blumenbachii*, and other Trilobites.
Silurian, Upper Grauwacke, or Transition System.	15. Caradoc sandstone	880	Shelly limestone. Various sandstones. } *Pentamerus*, Terebratula, *Orthis, Trilobites*.
Silurian, Upper Grauwacke, or Transition System.	16. Landeilo rocks	400	Calcareous flaggy beds, including *Asaphus Buchii*, and other Trilobites.

The stratified argillaceous rocks below, from the rarity of organic remains and other causes, are not yet completely understood. The following arrangement, based on the labours of Sedgwick, is however almost certainly correct with reference to the succession of deposits in the Welsh and Cumbrian districts. The thicknesses are insufficiently known.

System	*Names of Formations.*	*Remarks.*
	17. Plynlymmon rocks	Argillaceous indurated slate, sandy slates. No fossils yet found in it. Calcareous and argillaceous rocks, with Orbicula, Zoophyta, and other organic remains.
Cambrian System.	18. Bala limestone	Calcareous and argillaceous rocks, with *Orbicula, Zoophyta*, and other organic remains.
Cambrian System.	19. Snowdon rocks	Variously coloured and indurated argillaceous slate. A few fossils have been observed in Wales.
	Clay slate	Soft dark slate. No fossils known.

Skiddaw System.	Chiastolite slate	Soft dark slate, with chiastolite. No fossils known.
	Hornblende slate	Soft dark slate, with hornblende. No fossils known.
	Mica schist system	No or nic remains. The beds of mica schist, composed of mica and quartz, alternate w h gneiss, chlorite schist, talc schist, hornblende schist, clay slate, quartz rock, a primary limestone.
	Gneiss system	No or nic remains. The gneiss beds, composed of mica, quartz, and felspar, alternate lo lly with mica schist, quartz rock and primary limestone.

Primary Periods.

Oldest Systems of Strata.—Gneiss and Mica Schist.—Gneiss and mica schist, two of the most abundant of the oldest stratified rocks, appear, as to their substance, to be composed of the same parts as granitic rocks, viz. felspar, quartz, and mica, with great variations of proportions, and some admixtures and substitutions of other minerals, constituting alike granite, gneiss, mica schist, &c. But the ingredients are not in the same condition;—in the granite all is crystallized; each mineral is independently a crystal, or moulded in the cavities left between crystals; in gneiss and mica schist the felspar, quartz, and mica are rolled or fragmented masses. The character of worn surface of the ingredients, combined with the lamination or stratification of the mass, assures us that aqueous agencies have determined the aggregation of gneiss and mica schist: the character of the lamination, especially the minute flexures which abound in these antient rocks, suggests somewhat of peculiarity in the condition of the water; and the internal crystallization of the attrited felspar reveals its origin from the disintegration of granite.

On the other hand it has been contended that the similitude of the mineral composition of gneiss or mica schist to granitic compounds argues a similitude of origin; and by some writers gneiss, mica schist, &c., are regarded even as igneous rocks; by others it is thought that gneiss and mica schist are intermediate products between sandstone and granite, retaining the lamination and bedding which indicate their original aqueous origin, but assuming a new mineral composition in consequence of the agency of heat. Neither of these views appears satisfactory; to give a merely igneous origin to gneiss is evidently to leave out half the phænomena; to suppose the mineral composition of gneiss the effect of heat operating on a common sandstone will never be allowed by those who have studied the rock as it appears in Zetland, Scotland, or Norway; for in all these places it is clear that the granular minerals have not derived their external figure from concretionary but really from mechanical action, while their exterior structure is truly crystalline. There is however one mineral frequently found crystallized in gneiss and mica schist, viz. garnet; and the history of this mineral leaves no doubt that the rocks in which it lies have been pervaded by a general high temperature, enough to affect such a fusible substance as garnet, but not enough to melt any one of the regular constituents of granite. Here then appears decisive testimony as to the degree of heat which the gneiss and mica schist have experienced. By the operation of this pervading heat the particles of calcareous rocks associated with gneiss and mica schist have undergone a great change: they have been converted to crystallized marble of various colours and qualities.

The arguments above advanced, conclusive as we deem them on the subject of the origin of gneiss generally, are not intended to apply to cases where, by reason of this rock being buried at great depths below the surface, extraordinary effects of heat may be experienced. There, no doubt, the gneiss such as we see it, clearly revealing the history of its formation, may be wholly melted and re-crystallized, so as to lose entirely all traces of its origin. Some such cases may occur, perhaps even we may admit that evidence for them exists in uplifted granitic regions; and thus some of the monuments of the earth's early history may have been lost: but that this cannot be the general rule almost every mountain-chain bears testimony.

In these, the most antient rocks which exhibit to us the combined effects of aqueous and igneous agency, no traces of animal or vegetable life occur, and the conclusion we adopt on the subject is, that few or none of the organized wonders of nature were then in existence, because the physical conditions of the globe within which the existence of animals and plants is limited were not then established. Only one other view of the subject is worthy of notice. According to the hypothesis of the slow reconversion of stratified rocks to granitic compounds, the want of traces of organic forms in the gneiss and mica schist is ascribed to the destroying agency of heat on the calcareous matter of shells, corals, &c., and the carbonaceous substance of plants. That heat will affect such calcareous and carbonaceous compounds in the manner assumed is certain. Perhaps it might be difficult entirely to reject the hypothesis in the case of the primary limestones, whose alteration to crystallized masses may be thought to have wholly destroyed the structure of the shells. Yet as in the limestone of Teesdale, similarly altered by contact with trap rocks, crinoidal stems retain their forms; and as near granite, trap, &c., vegetable remains are recognised, if not in substance, yet at least by their impressions in the shales or grits; and as, finally, among some rocks of the same mineral nature as gneiss and mica schist shells and plants of many sorts appear in the Col du Chardonnet in Dauphiné, the balance of evidence is decidedly against this extreme application of the theory of metamorphism of rocks.*

Upon the whole then the evidence afforded by a careful examination of the oldest strata, in regard to their mineral composition, structure, and absence of organic remains, supports, we will not say establishes, the opinion that these are not only the most antient strata which man can trace, but the oldest products of watery action on the globe, and in a great degree anterior to the origin of organic life.

The general results to which the study of the earliest systems of strata lead are these:—

1. They are the oldest aqueous deposits visible on the crust of the globe, and rest on masses which have received their present aspect from the action of heat.

2. They furnish no proof of the contemporaneous or previous existence of dry land.

3. They are equally destitute of evidence of the contemporaneous or previous existence of plants or animals in the sea.

4. The rocks of this antient system are peculiar in their aspect, and though doubtless derived from disintegrated granite, &c., the constituent particles appear to have undergone much less attrition than those which compose rocks of later date.

5. These rocks are of such great extent as to approach nearer to universal formations than any of later date.

As a general inference, it appears that the circumstances which accompanied the accumulation of these rocks were greatly different from what we now behold, since nowhere on the sea-shores are any such products found, nor can we suppose any thing analogous producible in the bed of the sea, unless where some peculiar agitation of water may hasten the disintegration of granite. The impression was very strong among early writers of the entire want of accordance between the causes of those early strata and those now in action. De Luc (*Lettre* iii.) more reservedly says, 'We have no reason to expect that the operations of those times can be explained by specific analogies with what we observe in the present state of the earth.'

And as one general hypothesis, we may say with the followers of Leibnitz and Fourier, that the proper internal heat of the earth was then only just so much reduced as to allow of a peculiar watery action upon its cooling crystallized masses, but not enough diminished to allow of the conditions within which the existence of organic beings is restricted on the earth.

This hypothesis is independent of the consideration already presented as to the original condensation of the globe, and cannot, we believe, be objected to on the ground of anything known concerning the present state of the interior of the globe; on the contrary, the temperature of the earth augments as we proceed downwards, and this fact, being general, has been shown by Fourier to be inexplicable except as a consequence of a general high temperature now existing in the earth. The planetary spaces round the earth

* We find no vestige of organized bodies in these strata; none therefore existed in the liquid at the time it thus covered the globe.—De Luc, '*Lettre Troisième*,' Sept. 1793.

are colder than any part of its surface (Fourier), and continually abstract heat from it: the globe is continually growing colder though by an insensible rate, must have formerly been hotter, and then must have lost heat more rapidly. The obvious conclusion from the mathematical theory of the heat of the globe, coupled with observations of the temperature below the surface, leads to the adoption, as an inference from facts, of the view above proposed as an hypothesis to explain other facts.

Skiddaw, Cambrian, and Silurian Systems. — These argillaceous rocks of the primary series of strata bear the same relation to the gneiss and mica schist as common clays bear to common sands in modern nature. Some clays are not really more distinct from particular sands in their mineral nature than in the comparative fineness of their constituent particles. In consequence of differences of magnitude and density, particles of clays and sands, which are derived by watery action from the same sea cliff, avalanche, or glacier, are soon separated, carried to unequal distances, and deposited in distant masses. Such, in many cases, is the true origin of the sandstones and shales of the secondary strata, and processes somewhat analogous may perhaps be supposed to have occasioned the remarkable distinctness and even reciprocity of occurrence of the gneiss and mica schist on the one hand and the slaty rocks on the other. It is seldom that both of these types of primary strata abound in the same geographical region, though there is little doubt that both are derived from a granitic basis. In some cases we may best conclude that the materials of the slaty rocks were obtained from the wasted gneiss and mica schist.

Enormously thick as these argillaceous masses are, and extensive as is their geographical distribution, they offer in all countries a general character of aspect which easily arrests the attention and impresses the memory. The colour usually approaches to blue, gray, green, or purple; the texture is usually fine grained, but portions are included not very different from sandstone or conglomerate (grauwacke, or clasmoschist of Conybeare); the structure is laminated and bedded more or less perfectly, and often in addition complicated with regular symmetrical joints; there is another entirely distinct set of such divisional planes called 'cleavage,' traversing the planes of deposition; all these circumstances give to the primary argillaceous rocks a determinate aspect. The limited limestones which interlaminate the mass are seldom so crystalline as those in gneiss and mica schist, and they, as well as the upper and some other parts of the slaty rocks, generally yield organic remains, occasionally in great abundance. These are almost wholly marine (local deposits of land-plants occur), and the animals belong to invertebral tribes—zoophyta, conchifera, crustacea, and augment in number and variety as we pass from the lower to the upper parts of this series of rocks. (ORGANIC REMAINS.)

From a contemplation of the slaty rocks it results:—

1. They not unfrequently rest on the granitic rocks with scarcely any interposition of gneiss or mica schist. (Cornwall, Cumberland, &c.)

2. The proofs which they offer of the existence of dry land are chiefly (or wholly) derived from the organic remains of plants, which are not certainly known among the lower groups, but become tolerably plentiful in the upper parts of the systems.

3. The marine organic remains, shells, corals, crustacea, &c., are very scanty in the older systems, and grow more and more numerous and varied towards the upper strata.

4. The forms and structure of these earliest known fossil races of animals have no extraordinary degree of simplicity, nor are they confined to the lowest or least complicated tribes of invertebrata.

5. The alterations which the rocks have undergone by the action of heat are general, sufficient in most countries to superinduce new structures (slaty cleavage), but not to destroy the traces of organic remains.

A greater resemblance appears among these fine-grained strata to the deposits from modern waters than is found in the earlier rocks: there is less of peculiarity in their laminar and stratified structure; they are more varied; and the alternations of deposits indicate greater variety of natural processes and new conditions, such as the elevation of land, the wasting effects of the atmosphere, and littoral agitation, might occasion.

We may suppose, in order to account for the origin and gradual augmentation of the traces of organic life, that the flow of heat from within the globe to the surface was retarded by the effect of previous cooling, and by the addition of the older sedimentary rocks above the granite; and this is in harmony with the fact that generally the limestones of this system are less crystallized than those which are of older date.

Passage from the Primary to the Secondary Period of Geological Time.—Before the close of the Primary period we find that some limited tracts of land were reared above the waters, so as to nourish the plants which occur in the grauwacke slates of North Devon and the banks of the Rhine (supposing, with the general opinion, that the fossiliferous rocks of Baden, &c., are of this age). The sea had become entirely fit for the residence of marine zoophyta, which abounded so as to constitute reefs and islands; conchifera and gasteropoda forming extensive beds; trilobites of many kinds, and a few traces of fishes. These however are chiefly in the uppermost of the primary series, and would be ranked as transition deposits by all geologists who use that now neglected and somewhat hypothetical term. Yet it is impossible not to be struck by the gradation of character which connects into one long series the granitoid gneiss and the arenaceous Ludlow rocks; the fine-grained gneiss and mica schist with the fissile Snowdon slates and argillaceous Wenlock shale. (See the table of strata, page 138.) In proportion as the deposits on a great scale resemble in character of accumulation those of modern times, so the organic remains appear more and more abundant. Some general change of physical condition, such as perhaps only a change of heat will explain, must evidently be admitted as an hypothesis to connect together this series of phænomena.

After the deposition of the primary strata, the interior forces of heat, no longer operating by a gradual metamorphosis of the previously deposited strata, and by a regulated change of the condition of the sea, appear to have been thrown into a state of critical action, and to have operated on the aqueous deposits of antient date, as at this day the volcanic fires below affect the sedimentary strata accumulated from water above. There is hardly a mountain-range of much importance throughout the world where the effects of great convulsive movements affecting the primary strata cannot be seen: frequently it is ascertained to be the case that these movements happened before the production of any of the secondary rocks; and upon the whole it is evident that the crust of the globe was broken up and disturbed, and the relative geographical distribution of sea and land materially changed by the disturbance. The effects immediately appear: the introduction of a new order of sedimentary deposits, with new geographical relations; the extinction of old and the creation of new groups of organic beings; the commencement of a new act (so to speak) in the great history of the earth.

What relation do the great convulsions here alluded to bear to the movements of a modern earthquake? They are unquestionably due to the same general force, viz. internal heat: a disturbance of the equilibrium of this force is in each case to be admitted—the causes and effects are analogous—but is the modern earthquake due to a physical agency of equal intensity with that which occasioned the antient convulsions of the earth's crust? The uplifting of a mighty range of mountains is a common event, a characteristic occurrence of early geological periods: minute and partial changes of level accompany some modern earthquakes. There is no possibility of explaining the former by the latter, except by taking them as differential quantities, proportioned to the time elapsed; assuming that they always (or on an average) operated in a certain direction; and thus summing an almost infinite series of minute changes to make one decided revolution. This is, and must necessarily be, the view of the advocates of the invariable constancy of the measure of natural agencies.

It is enough, in reply to this speculation, to point to the phænomena which require explanation: they are too mighty in extent, and have too much simplicity and even rarity of character, to allow of the faintest belief that this hypothesis can be true. On a minuter inspection this conviction is deepened by the want of any proof of the occurrence of these thousands of small movements, which must have succeeded one another for the production of the given effect. On the contrary, the enormous and simple displacements,

100 to 4000 feet in a vertical line, and ranging 10 or 100 miles in length; the mutual connexion of such faults; the laws of their relative direction, and other phænomena, utterly reject such an imaginary representation of the measure of primeval igneous agency. A much less improbable view, that the whole movement of a great mountain-chain was accomplished by gradual elevation or depression, operating through long time in one direction, is apparently difficult to reconcile with the narrow and steep ridges produced, the numerous and powerful flexures of thick rocks, the sudden and great fractures, and other characteristic phænomena.

We are therefore driven to believe that the igneous effects of earlier date were far more powerfully and generally excited, at particular epochs, than is now observed to be the case. We may be satisfied that the present aspect of the earth is to be viewed as a period of comparative repose; a period of ordinary and regular action, and frequent compensation among the agencies of nature; and may satisfactorily compare it with the whole or some part of the primary period, but not use it as a measure of the violence which accompanied the transition from one early period to another, and thus, amidst great local or general disorder, restored the equilibrium of the interior and exterior agencies of natural changes. This being supposed, the volcanic excitements of modern date being taken as the terms of a series of effects of partial and local disturbances, and re-establishments of equilibrium, there may yet remain residuary phænomena not so compensated, till some critical combination of events opens a wide access to the interior energies of heat. It is even probable that such do remain. The cavities left by the ejection of lava under the Andes are probably not all compensated by the sinking of the earth in the vicinity, because of the resistance of the coherent crust of rocks above; yet such resistance is limited, and it is at least conceivable that some part of that mighty range may fall in, as did a great portion of Papandayang in Java (1772).

What is here concluded to be true at this day for volcanic regions taken singly, may easily be assumed to be probable for large portions of the earth, when the igneous energy was capable of more general results, because not determined to many local centres of continual or intermitting effect. But we must not leave out of consideration the gradually diminishing force of heat in the globe, whether this be due to a gradual lowering of its proper temperature, or a gradual stilling of calorific chemical processes. The loss of that heat by mere radiation into the cold planetary spaces is a residual phænomenon of infinitesimal value indeed, but of general application to the whole globe, and capable in long time, and independently of local volcanic action, of amounting to a tremendous force. For the heat of the surface of the earth being determined by the heat of the sun and the cold of its planetary path, the exterior crust would contract less than the interior nucleus, and it would depend on various considerations whether at all, and after what intervals, a violent crushing of the crust should happen to relieve the extension of the solid or fluid nucleus. During the earlier periods of refrigeration such critical disruptions may have been frequent; at later times they would occur after longer intervals, with greater violence; and finally, when solidification had gone to a certain depth, there might be no subsequent paroxysm, so long as no external agency came to aid the interior tension.

It may perhaps be worth remarking that the atmosphere of the earlier æras of the world known to geology must be supposed to have transmitted light, much as happens at present, else we should not find the eyes of fossil trilobites constructed as are those of analogous crustacea at this day. (See Dr. Buckland's *Bridgewater Treatise.*)

Secondary Periods of Geology.

On the undulated bed of the sea, round the ranges of primary rocks raised in insulated tracts by great convulsion, secondary strata were formed, sometimes evidently derived from the waste of the primary strata, through the influence of atmospheric agency, or the wearing of the sea on its shores. But a considerable portion of these strata is of purely marine origin; the calcareous strata may be considered as derived from chemical decomposition of the sea-water, separated from it by the vital functions of mollusca and zoophyta, or generated by springs rising in the sea and loaded with carbonate of lime. Of all these modes of formation modern nature offers illustrations, some of them so extensive as to admit of comparison with many of the antient limestone rocks. Others of the secondary rocks appear to have been formed of ejected volcanic matter, ashes and scoriæ, which by diffusion in water have settled into deposits of considerable extent. The total thickness of the secondary rocks is but small when compared with that of the primary groups, nor are they, it is probable, spread over such extensive areas; but in the variety and number of alternations of the different sorts of rocks and in the diversity of their imbedded organic fossils they are altogether superior. There is among them far more of the differences which separate oceanic from littoral deposits; and we see abundant proof that during their aggregation the arrangements of nature were extremely analogous in general features to what we now see, however great and numerous the points of difference may be.

On an attentive consideration of the several systems into which the secondary strata are grouped, viz. (in the order of superposition):—

- Cretaceous System;
- Oolitic System;
- Saliferous or Red Sandstone System; and
- Carboniferous System;

it will be perceived that to each of them belong littoral, marine, and oceanic deposits; sandstones having been chiefly collected amid the agitation of the shores, clays accumulated in quiet bays or gulfs, and limestones aggregated in deeper water; and in each system, each of these classes of deposited rocks contains somewhat characteristic, if not entirely peculiar: sandstones, more or less felspathic, dark bituminous shales, and grey limestones occur in the carboniferous system—red or blue colours belong to the sandstones and clays, and magnesian combinations to the limestones of the next incumbent rocks; light-coloured sands and pale blue clays, with yellowish limestones, mark the oolitic system; and green or ferruginous sands, marly clays, and soft white limestones distinguish the cretaceous rocks.

These distinctions are important, as guiding us to a right general view of the changes of physical conditions which occasioned them. These, it is probable, related chiefly to hydrography, and when we have geological maps complete enough to make the required comparisons as to the extent and distribution of the rocks, it appears possible that the direction of oceanic currents, the lines of antient boundary of land and sea, may become sufficiently known to determine the particular subterranean movements which introduced new conditions and produced new deposits in a given basin of the secondary ocean.

Each of the great systems alluded to is characterised by the plants and animal remains which lie in it: the lepidodendra of the carboniferous sandstones and shales yield place to the voltziæ of the red sandstone, and the cycadeæ of the oolites; the productæ of the carboniferous limestone are never seen among the oolites, which abound with trigoniæ, pholadomyæ, &c., nor in the chalk, from which these forms are absent; ammonites belong to all the systems, but the groups differ in each; belemnites are confined to the two upper; hamites, scaphites, &c. are scarcely met with out of the cretaceous rocks.

These statements might be enormously multiplied [Organic Remains], but enough is said to show that the great features of lithological distinction are accompanied by striking characters of organic remains. These characters, so far as marine life is concerned, may evidently be understood by the same inference of a change of oceanic currents; but the differences of the vegetable world seem to bespeak a general change of the characters of climate.

Reviewing the four systems in succession, we shall find circumstances in each strongly indicative of peculiar combinations of the physical agencies of nature.

Carboniferous System.—To what shall we ascribe the abundance of vegetation which furnished the materials of our coal strata?—an abundance so great as, upon any hypothesis of accumulation on the spot where the plants died, or in the sea to which currents drifted them, appears to have no parallel unless amongst the most umbrageous forests of Tropical America. By the gradual decay and periodical transport of the woods on the Mississippi or Orinoco we may perhaps best understand the accumulation of many beds of coal, alternating with a far greater number of much thicker earthy sediments; but even these aboriginal forests seem unequal to produce such enormous coal deposits as we find in Britain and other

parts of the northern zones of the globe. The circumstances, whatever they were, which favoured this development of vegetable power, were never repeated, at least in these zones, though deposits of a similar nature to the series of coal strata, and likewise containing fossil plants and thin beds of coal, diversify the sand and sandstones of the oolitic, cretaceous, and tertiary æras.

As carbonic acid existing in the atmosphere is the source of the carbonaceous substance of plants, M. Adolphe Brongniart proposes the speculation that it was a great abundance of this ingredient of the atmosphere which favoured vegetation in the carboniferous æra; and he finds support to his view in the fact that during this same period there is almost no trace of the existence of any land animal whatsoever. Now land animals and land plants are, with respect to carbonic acid, in reciprocal relations; the former yielding by respiration what the latter receive by absorption. Carbonic acid is one of the supports of vegetable life; plants of particular sorts may flourish even more abundantly by an addition of it to the air: to animals its excess is poison. To this speculation the constancy of the atmospheric ingredients, as determined by analysis, cannot be objected; for this art, perfected in the 19th century, by no means confirms but rather rejects the notion of such constancy. In how many ways is oxygen fixed and liberated by processes now going on in and upon the land and sea? Who can say if even now its proportions to nitrogen are constant? Is it even proved that any really chemical combination exists between them? Much more should we hesitate to award such constancy to carbonic acid, for this is known to vary in different situations and circumstances. Suppose only 5000 square miles of coal-beds, twenty yards thick, derived from vegetable ruins to be again converted to carbonic acid and distributed over the globe, what would be the result on the proportions of carbonic acid and oxygen in the atmosphere?—what the effect on vegetable and animal life?* More than this quantity of coal has been discovered in Great Britain and Ireland alone in the carboniferous system, and it must have been derived from plants growing on a small extent of the earth's surface. The fossil plants of the coal series have been generally considered by eminent botanists, since the days of Jussieu, as decidedly indicative of a warm climate; the state in which they occur in the earth proves that they have not been drifted far: we are therefore to infer that in latitudes as far north as Moscow, Edinburgh, and Nova Scotia, the land enjoyed near the sea a climate analogous to that now found on the shores of Brazil or in the Isle of France. The same conclusion as to the sea, with rather greater distinctness of evidence, arises from the corals which abound in the carboniferous limestone.

As a general inference we may observe that all the great thickness (2000 or more yards) of the carboniferous system (excepting perhaps part of the old red sandstone series) is clearly derived from wasted lands or sea-coasts, or from a decomposition of the sea-water by vital or chemical agency.

Disruptions of the Carboniferous System.—Whatever was the length of time which elapsed during the accumulation of the carboniferous strata, it appears to have passed with little disturbance of the level of land and sea; for not a single example (we believe) is mentioned of any real unconformity of stratification, in the whole series from the base of the old red sandstone to the uppermost line of the coal strata. The ordinary agencies of the atmosphere and the waves were in full employ, and some traces of volcanic eruptions appear in the trap of Derbyshire and the north of England; but there is not in the accumulation of the often repeated alternation of limestone, sandstone, shale, &c. of the carboniferous system, any thing to require the supposition of greater general convulsions. It was a period not of repose, but of regular and orderly action among the agencies of nature, so far as the parts where now Europe and North America are situated: and the mineral deposits and organic remains are to be compared with existing operations of nature in order to learn the physical condition of the antient land and sea.

After the formation of the carboniferous strata was ended in Europe and America, the long tranquillity of the ocean in these parts was broken by extensive and violent concussion, so that hardly a single square mile of country can anywhere be found which is not full of fractured and contorted strata, in consequence of subterranean movements which mostly preceded the accumulation of the next system of strata.

The relations of land and sea were so greatly changed by these transient convulsions, that the new ridges of land and islands appear to have been variously scattered in the ocean which flowed round the already uplifted Grampian, Scandinavian, and Welsh mountains. An equal or greater extent of land appears to have been elevated in Ireland, but with less violence and concussion; and it is remarkable that some of the greatest faults produced at this epoch were almost wholly unaccompanied by the irruption of any igneous rocks, or any other signs of merely volcanic action (Craven fault, great dyke of Tynedale, South Wales coal field, &c.)

Some more general and more powerful agency than that which we now see in the volcano and the earthquake must be invoked to explain the great and extensive displacement of land and sea which broke, with transient violence, the long quiet of the globe, and gave rise to a new and general change of deposits.

The Red Sandstone System, which is deposited upon and around the broken tracts of the carboniferous system, presents us in some respects with new conclusions, which however seem almost equally to apply to the old red formation. No doubt the sands and clays of this system were collected from wasted land and sea-coasts, and deposited in shallow waters. But whence came the red and greenish colours so characteristic of these strata and the analogous old red formation? The grains of sand which compose much of the rocks are not red, but white rolled quartz sand, surrounded by red peroxide of iron like a varnish. From none of the older rocks could this abundant red pigment be derived so as to stain the whole sea bed for 1000 feet or yards in depth; but we may perhaps appeal to volcanic forces to solve this curious problem. Oxide of iron is one of the most abundant of the substances among volcanic ejections. before the deposition of the red sandstones, enormous and general disruptions of the coal and limestone strata happened, which implies an unusual exertion of igneous agency: the lower parts of the series are full of conglomerates, the natural consequence of the violent displacements of preconsolidated rocks.

Instead of the great quantity of vegetable matter buried in the coal tracts, we have in the principal part of the red sandstones hardly a few insignificant traces; so few in England that scattered fragments are valued in geological reasoning: neither are the marine reliquiæ of the magnesian limestones in the midst of the red rocks at all plentiful, except in a few spots. Even taking the richer German series as a type, the red sandstone rocks must be pronounced singularly deficient in organic fossils; and as, generally speaking, the same deficiency of organic life belongs to the older red sandstone below the mountain limestone, it is at least a plausible supposition that the causes of the red colour and paucity of animal life are somehow closely connected. If we imagine that by reason of the great convulsions which followed the carboniferous æra new currents were brought into the same areas of the ocean, from tracts yielding abundance of new sediments, the extinction of organic life would be the natural consequence, to be followed afterwards by a gradual revival—which is nearly the truth. In the magnesian limestones of this system expire many of the forms of the older carboniferous period, and at higher levels (as in the muschelkalk) we find a strong resemblance of the marine zoophyta shells and crustacea to those of the younger oolitic system. Upon the whole there seems reason to think the new red sandstone system could not have occupied a long time in its formation, compared to other deposits of equal thickness.

Oolitic System.—Into the same European and Asiatic basins which received the red clays, red sands, and magnesian limestones of the last system, subsequent agencies brought blue clays, sands more or less ochraceous, and limestones characterized by an oolitic texture. These deposits are parallel to the old rocks below, and no trace of any change of level in the region where they occur has been noticed in England—perhaps not in Germany. Must we refer to some distant convulsion for an explanation of the change of sediments, and for the equally great change, or rather, sudden development, of organic life, which comes in with the oolitic æra? New and more abundant forms of plants (cycadeæ), with

* The quantity of carbonic acid gas now existing in the atmosphere does not exceed the one-thousandth part. By the addition supposed it would amount to the eight hundred and fiftieth.

many varieties of zoophyta, mollusca, crustacea, fishes, and gigantic reptiles of the land, rivers, and the sea, mark the oolitic rocks, and render them justly comparable, as a system, to the great carboniferous assemblage of strata. Locally indeed the oolitic rocks yield coal among the interpolated grits and shales, just as happens among the rocks interstratified with the older mountain limestone.

The resemblance of the oolitic to the carboniferous limestone tracts is extremely great in general features; and the reason is that both are essentially sea deposits, characterized by calcareous rocks formed in the deep sea, and liable to admixtures of sandstone and shales along the shores. In such situations each is carboniferous. Both are highly rich in oceanic life, but during the formation of the oolitic rocks there is no proof that anywhere such excessive richness of vegetation was renewed on the land as that which yielded the mass of coal plants in an earlier period. The state of the earth during the carboniferous period was compared to that of the tropical parts of America; during the oolitic periods it rather resembles the south-eastern shores of Australia, and indeed special analogies may be traced in both instances. There seems almost no equivalent of this oolitic period on the north American continent, but the carboniferous rocks occur in America, India, and Australia.

Cretaceous System.—The last portion of the series of secondary strata was deposited in the same oceanic basins as the earliest, as far as Europe is concerned, but this is not the case in America. Generally, in Europe the cretaceous rocks have their stratification parallel to that of the oolites, though some unconformity in this respect occurs in Yorkshire and Dorsetshire, and in the south-east of France dislocations affected the oolitic strata before the production of the cretaceous rocks. But these comparatively slight movements of the bed of the sea appear totally insufficient to account for the complete change in the chemical and mineralogical character of the rocks, and the new orders of zoophyta and mollusca which date from the commencement of the cretaceous æra.

Sands coloured green by silicate of iron, white soft limestones with beds or nodules of flint, seem to bespeak an origin from the waste of other lands than those which discharged other sands into the oolitiferous sea, and other modes of chemical or vital action in the sea: yet a scrupulous analysis of the oolitic system shows in its upper part analogies to the cretaceous rocks so strong and so various as to render it probable, if not certain, that the new conditions characteristic of the new system were gradually or partially introduced till they entirely predominated;—for green sands alternate with the uppermost of the oolitic limestones in the Alps; flinty nodules lie in the calcareous grit and Portland oolite, and chalky limestones constitute the great portion of the latter rocks in some situations of England. It is to be regretted that we are so little able to determine upon good evidence what the new conditions influential on the deposits of the cretaceous rocks were; for their effects are very similar along a great range of the Atlantic coast of North America from New Jersey to the Mississippi, and throughout the interior of Europe.

The cretaceous period was not ended in England by dislocations situated in or even near that part of the surface. In Ireland eruptions of basalt of enormous extent cover the chalk, and indicate a crisis of volcanic disturbance. In France Elie de Beaumont refers to the concluding part of the cretaceous period dislocations which range north-north-west in the Jura, and traverse the primary mass of Mont Viso. After the chalk formation was completed in the south of France the Pyrenees were uplifted to a great height, so as to limit the tertiary basins of the south of France; and it is supposed that at the same time the Apennines and Carpathians experienced an upward movement. Conjecture has even joined to these the Alleghanies, but it may be gathered from Professor Rogers's reports on the geology of America (*Brit. Assoc. Reports*) and accordant notices of Featherstonhaugh and other competent geologists, that an earlier date should be allowed to that mountain-range.

Tertiary Periods.

In general no contrast can be more complete than that between the secondary and the tertiary stratified rocks: the former retaining so much uniformity of character, even for enormous distances, as to appear like the effect of one determined sequence of general physical agencies; the latter exhibiting an almost boundless local variety, and relations to the present configuration of land and sea not to be mistaken. The organic bodies of the secondary strata are obviously and completely distinct from those of the modern land and sea; but in the tertiary deposits it is the resemblance between fossil and recent kinds of shells, corals, plants, &c., which first arrests the judgment. In general there is a decided break between the two groups of rocks—a discontinuity which is nowhere completely filled. Yet, besides the pseudo-tertiary or transition chalky rocks of Maestricht and the Pyrenees, and the conchiferous marls of Gosau, we have in England and France above the chalk a prevalence of green and ferruginous sands extremely similar to those below. Perhaps they have been derived from the waste of these older rocks; Mr. Lyell supposes the tertiaries of the London basin to have been formed from the waste of the secondary strata of Kent, Surrey, Sussex, and Hampshire.

With the tertiary system came into existence (if we may trust the negative evidence which the earlier strata present) many races of quadrupeds, some birds, reptiles, and fishes, extremely analogous, though for the most part specifically distinct from the modern denizens of land and water; thousands of corals, shells, crustacea, &c., which present with living races quite as great analogy as obtains between the tribes of the Atlantic and the Pacific oceans of our day: the general features of land and sea as they now exist begin to appear, and there can be no doubt that in a philosophical study of the revolution of the globe the tertiary æra of geology cannot be properly separated from the existing system of nature.

Yet during the deposition of these rocks the relations of land and sea were greatly altered in Europe by the rising of the Pyrenees beyond the height they reached after the cretaceous æra, and by the uplifting of the Alps from the Mediterranean towards Mont Blanc. In England we may believe the upward movement of the southern counties connected with the Hampshire axis of elevation and the Isle of Wight convulsion, was ended before the close of the tertiary period. The eastern range of the Alps from Mont Blanc to Vienna is of later date, and may be viewed as the most marked phænomenon of elevation which accompanied or preceded the dispersion of erratic rocks in Europe

§ 7. Present Aspect of the Globe.

Physical Geography.—According to every view of geological causes and effects, the present aspect of our planet is the result of all its previous changes; these changes cannot be completely understood if we leave out of consideration the daily variations which occur in the condition of the earth, nor can the operation of existing agencies be completely represented to our minds without calling in aid the inferences derived from a study of earlier phænomena.

One of the most important things ascertained by geological investigation is the certainty that the operations by which stratified rocks were formed in the sea-bed, and the igneous rocks uplifted from below, were repeated nearly in the same succession over most parts of the globe. Some of the formations are very extensive: in all countries the lowest strata are of the character of gneiss, mica schist, slate-rocks, &c. These primary strata may almost be termed universal: the organic forms which they contain, though few, are very similar or exactly identical, over enormous areas; and there can be no doubt that during the deposition of these antient rocks the earth enjoyed a uniformity of conditions over its surface never since repeated. There is no proof that land existed anywhere in the earlier part of this period—no probability that any part of our continents or islands then stood above the water. At the close of the primary period the effect of elevatory forces was manifested by the existence of some narrow ridges and peaks of rocks, corresponding to some of our present mountain-tracts, as the Grampian and Cumbrian mountains, and of others now vanished, which nourished the forests and herbs whose destruction has yielded coal.

Through the secondary period this elevation of land proceeded gradually, or by intermitting action, till at the close of that period some of the principal features of European geography were visible; the ocean was contracted and divided into many basins and gulfs, some of which remain, as the Adriatic, English Channel, German Sea, &c., while others, as the Vale of the Danube, Sea of the Rhine, &c. have been dried by further elevation.

The same elevatory action, continued through the tertiary æras, completed the geographical features of Europe, and though we cannot trace so minutely in other parts of the world the contemporaneous changes, enough is known to assure us that the same causes have, within the same general limits of time, produced, in all quarters where dry land appears, the same phænomena.

Elevation of Land.—In the preceding pages we have spoken of the elevation of land from the sea as a thing perfectly well understood, and admitted as a basis of reasoning. It is so admitted by geologists of every shade of opinion who wish to explain effects by real causes. Yet, as some persons who read this may desire to see the process of argument by which, if doubted, it might be proved, we shall present a short sketch of the reasons which have produced on this important point a general agreement among geologists.

1. In existing nature the combined influence of the exterior and interior causes of change cannot materially affect the level of the sea (as estimated by the mean radius of its surface). Within sensible limits the sea-level is now permanent. This is sufficiently apparent by the reasoning in § 4 of this treatise. 2. The land now above the waters was formerly below them, and could only have been laid bare by the elevation of parts of the sea-bed, or by the abstraction of the ocean to other regions, either through depression of its bed or through a displacement of the axis of rotation, or by a universal diminution of the quantity of water on the globe, or by a change of the oceanic level through great alterations of temperature at the surface, or through the mass of the globe.

In examining these possible modes of desiccation of land, geology must have recourse to collateral science. The two last hypotheses, viz. of a change of oceanic level, without change of external form or axis of rotation, are insufficient for the purpose. Sound reasoning rejects the supposition of an indefinite waste of oceanic waters for miles in depth, because the position of our planet in space yields no escape for the water; nor is there any ground for believing that the quantity fixed in mineral compounds since the date of the earliest strata is of much importance. A general change of temperature of the globe would certainly alter the relative level of land and water, because their rates of expansion and contraction are unequal. Between the boiling heat, 212°, and what is probably below the mean temperature of the actual seas, 40°, the contraction of the water would be about ·042 of the whole quantity. The land certainly would contract less, and thus by a general cooling of the globe the ocean-level would relatively sink. To put the case to extreme, we shall suppose the contraction of the land = 0, the area of the water to remain unchanged, and the mean depth of the sea ten miles; the reduction of level of the ocean would be $\frac{42}{100}$ of a mile = 739 yards. Now as all the conditions of the problem have been taken in extreme, as the deepest part of the sea probably does not exceed ten miles, as one quarter of the spherical surface is land, and the area of the sea must diminish as its level sinks, it is very obvious that the greatest possible change of oceanic level from this cause could only go to one, two, or three hundred yards at most; and therefore it is impossible by such means to explain the desiccation of land from 1000 to 10,000 or 20,000 feet high.

Moreover, during this cooling of the land and sea the whole globe would contract; and from this cause the mean radius of the ocean diminish and its mean depth augment, so as to reduce still more the possible extent of land that could be drained by its change of dimensions.

The attraction of the ocean to other regions would lay dry parts of its bed; and if astronomical science permitted to geologists to change at their pleasure the position of the axis of rotation of the earth, few difficulties need stop the career of speculation; but the earth is a spheroid of revolution, and if the attraction of the heavenly bodies in the various positions which it takes with regard to them does not disturb its axis of figure, neither can it be thought that the volcanic fever of its surface can so alter the interior densities as to cause any sensible change in this respect.

But that the bed of the sea may have sunk, that other continents than ours may have fallen below their antient level, may be assumed as readily as the rising of the existing land; but with this restriction, that the sinking of the bed of the sea requires to be far greater than the rising of the land, because three-quarters of the globe are covered by water, and thus a small difficulty is overcome by introducing a greater.

Finally, on turning to the phænomena connected with mountain chains, it is perfectly certain from the position of the strata – often vertical or contorted in the sides of chains, highly inclined near them, and gently sloping at greater distances—that these rocks have been displaced by an elevating force acting from below. The direction of the force, the geological time of its occurrence, its sudden or gradually accumulated intensity, and many other characteristic circumstances, can be determined; and upon the whole no doubt remains that elevating movements have raised the land, and there is no reason to deny that depressing movements may have sunk the bed of the sea. Our limits prevent the farther development of this subject.

Outline of Land and Sea.—Througnout all the globe the outlines of land and sea depend principally on the disposition of mountain-chains and groups, which in every instance yet known are certainly shown to have been raised by mechanical agency, generally with a degree of violence so great as to require the supposition of great and general excitement of the subterranean forces of heat. America, for instance, derives its form from the chains of the Andes and Rocky mountains, the littoral range of Brazil, the Alleghanies, &c.; mountains probably of very unequal antiquity. The Ghauts define the western side of India, as the Atlas marks the north-western border of Africa; the Pyrenees and Sierras give the form of Spain; the Cornish, Welsh, Cumbrian, Lammermuir and Grampian ranges explain the figure of England and Scotland.

Frequently however this dependence of the form of the existing land upon the ranges of mountains is disguised by the extent of comparatively plain country which separates the mountains from the sea. Thus all the eastern half of England might seem to have its form independent of the narrow ridges of the western mountains; and it is but a vague relation which links the Baltic, the Black Sea, and the Caspian to the Harz, Saxon, Carpathian, Caucasian, and Uralian chains. In these and many other cases it is necessary to admit that the general level of the sea has subsided, or that large tracts of land have been raised gradually, or by successive movements around the mountains, which in earlier times were uplifted by more violent effects. The diagrams, *figs.* 2, and 3, p. 137, illustrate the fact of the general slope of the English strata from the western mountains; but this cannot be explained by the violent elevation of these mountains, for this happened principally before the deposition of the coal strata. A large area round these mountains has since been gained from the sea by more gradual changes of level.

Similar phænomena present themselves in detached areas all over the world; but in very unequal degrees, and with unequal differences of level above the ocean, even in neighbouring tracts. It appears therefore more probable that particular regions have risen round the same points and lines which once experienced a violent upward movement. There is no reason to deny that the ocean-level may have been somewhat lowered by the subsidence of a part of its bed; but it has been already shown that no reasonable (perhaps no possible) sinking of the ocean-bed could explain the phænomena of the desiccation of even the flatter parts of the land.

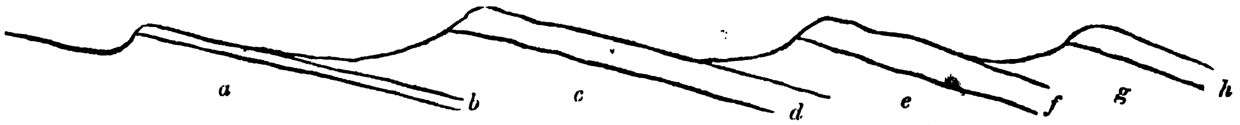
Interior aspect of a Country.—The interior features of every country in like manner depend upon recognised geological agencies. The unequal elevation of mountain-ranges above the sea is a phænomenon which will be found of great importance in geological theory. It appears to be true, at least in Europe, that the most elevated chains of mountains are those whose elevation was not ended (if, indeed, it be yet ended) until the tertiary or later epochs. Thus the Alps, which bear on some of their heights (Diablerets), caps of tertiary strata, ascend to 15,660 feet above the sea: the Pyrenees, whose principal elevation appears to have followed soon after the chalk, to 11,270; the Carpathians, nearly of the same date, to 8675 feet; while in the Harz the older mountains (Brocken) rise to 3739; in Wales (Snowdon) to 3675; in the Grampians (Ben Nevis) to 4350. The highest point of Norway Schnee-Haten is more than 8000 feet above the sea, but there can be no doubt that violent as well as gradual upward movements affected the Scandinavian ridges to a late geological æra.

sed in this manner by violent or gradual movements f the sea, the dry land has since been subjected to e by atmospheric action; and there is no doubt of the th, that to different sorts of rock belong some differences aspect, some characteristic scenery. The forms of the hills and valleys are not the same in the gneiss and mica schist of the Grampians; the clay-slate ranges of Wales; the limestone of Derbyshire; the oolites of Gloucestershire; the chalk of Wiltshire: even single rocks and waterfalls have distinctive characters, and the whole aspect of a country changes with its geological structure. It thus appears that the nature and structure of the rocks, their elevation above the sea, and the manner in which they attained it, and the intensity and duration of the atmospheric agencies which have since affected them, are the elements which determine in every instance the physical aspect of a country.

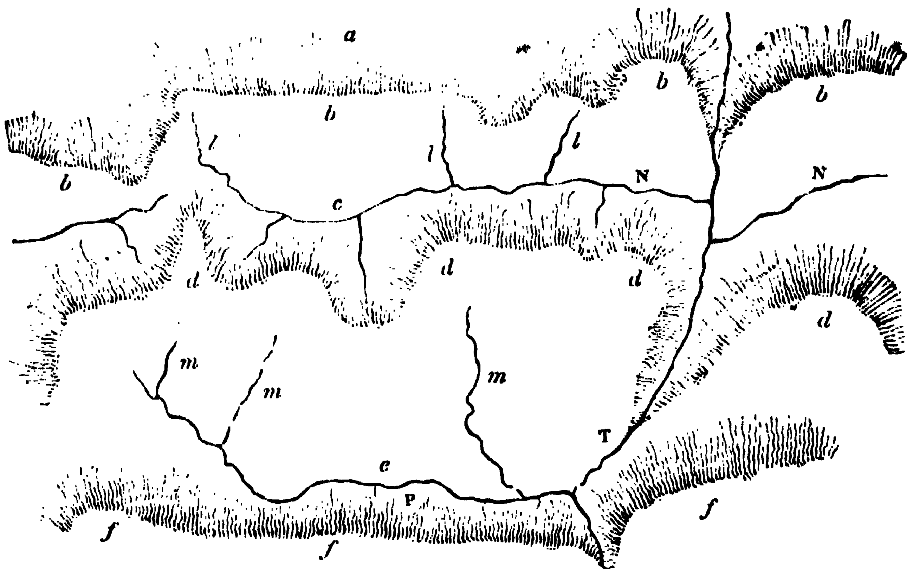
Valleys.—No question in geological theory has been the subject of so much debate, with so little of correct reasoning, as that of the origin of valleys. By Dr. Hutton it was contended that atmospheric agency and running waters had excavated valleys; by De Luc the subsidence of the crust of the earth was invoked; Omalius D'Halloy introduced the consideration of dislocations on the line of the valley; and Dr. Buckland appealed to the overwhelming force of a general flood. None of these views is entirely wrong; each contains partial truth; and the complicated problem of the inequalities of the surface of the earth can be solved by combining them. This solution may be attempted elsewhere we can here present only some of the principal data.

By violent elevation from the sea, rocks, of whatever nature or structure, must have been variously broken and fissured. It is conceivable that some of these fissures might descend below the level of the water. During the elevation some considerable effect on the forms of the ridges and hollows would be produced by the agitated water, but the smaller modifications which they have experienced must be ascribed to atmospheric agency. In these few words we have the history of the rough hills, abrupt valleys, and deep lakes which belong to mountain chains like the Grampians, Alps, and Pyrenees.

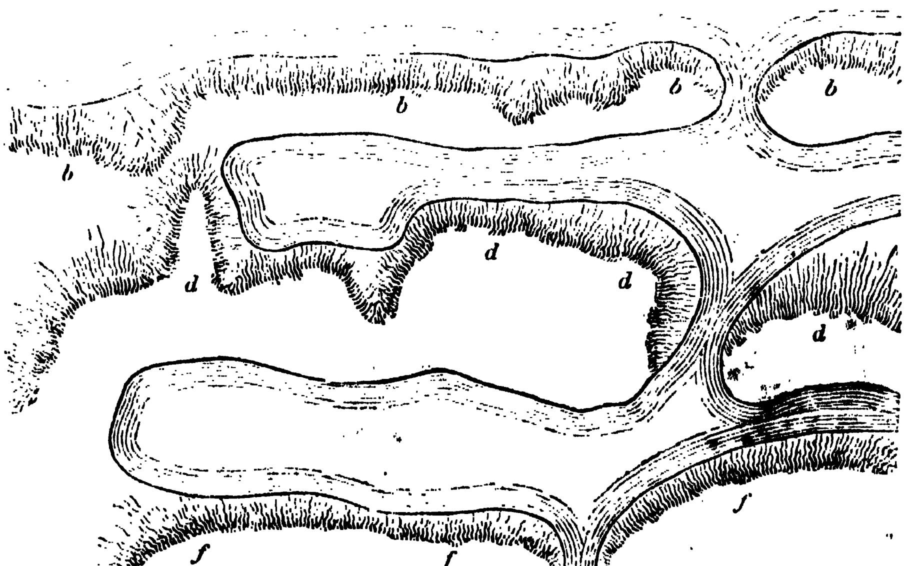
By gradual risings or interrupted lifts of the bed of the sea, other phænomena would arise; the action of the sea upon the rocks, successively brought within the sphere of its littoral movements, would concur with the form of preexisting land, and the entrance of its drainage waters, in extending the old and producing new valleys. The greater number of these extended or new valleys would be directed at right angles to the axis of elevation in progress, and therefore, on the dry land, the greater number of valleys originating in these circumstances will be found to run with the dip of the strata. How exactly this agrees with



No. 4. *a*, Red marl; *b*, lias limestone; *c*, lias clays; *d*, lower oolite formation; *e*, Oxford clay; *f*, middle oolite formation; *g*, Kimmeridge clay; *h*, upper oolite.



No. 5. *a, b, c, d, e, f*, have the same meaning as in the figure 4; *l l l*, *m m m* valleys which descend with the slope of the strata, here supposed to dip south; N N, and P, longitudinal valleys, or such as run parallel to the outcrop of the strata; T, a transverse valley, uniting the longitudinal ones.



No. 6. The letters have the same signification as in Nos. 4 and 5.

the general character of the drainage channels of the secondary strata of England above the red sandstone requires only to be mentioned; and it has been already shown that in all the south-eastern parts of England where these strata occur there is sufficient evidence that the elevation of these rocks was due to gradual and long-continued, not violent and transitory movements. While such gradual movements occurred, and strata of unequal hardness and different structure (as limestone and clay, or sandstone, in diagram No. 4), were brought within the range of littoral action, these would be unequally affected by the tidal and other currents; the softer parts would be worn away, the harder remain; and thus the red marl would be wasted parallel to the coast-line, or to a certain depth in the water, below the cap of lias limestone; the lias clays would yield beneath the crown of lower oolite; the Oxford clay be excavated below the middle oolite; and the Kimmeridge clay form a vale between the middle and upper oolites.

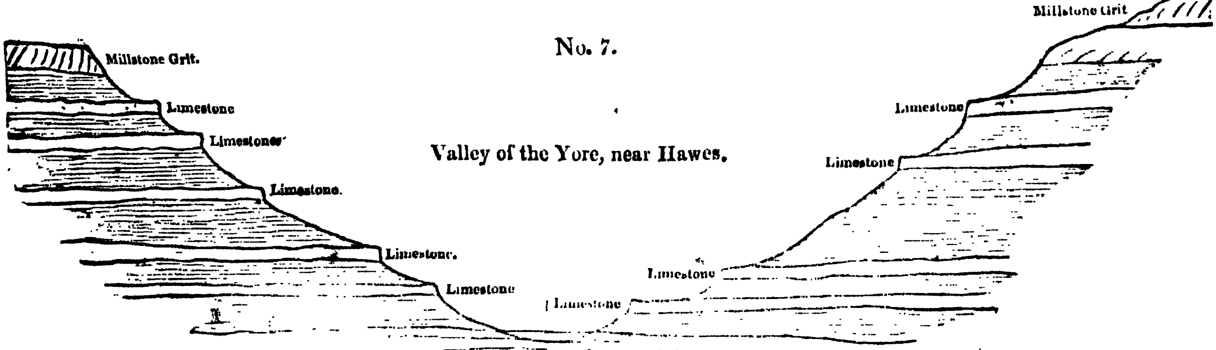
The exact conformity of this with the appearance in nature is well known. The general character of the actual drainage, as Dr. Smith has often and elegantly explained, may be represented in diagram No. 5, where *l l l* and *m m m* are valleys descending on the slopes of the strata, N N and P valleys formed in softer strata parallel to the coast; T a transverse valley uniting the others.

In the next diagram (No. 6) the same country is represented as rising out of the sea, which penetrates by the transverse valley across the ridges of rocky hills, and flows round them up the vales of clay; its waves wasting the clays under the cliffs, and causing the top to fall, exactly on the same principle that waterfalls at this day, by wasting the argillaceous basis, break down the crowning limestone beds throughout all the north of England.

The Giesbach, on the lake of Brienz, compared with the Staubbach; Hardrow Force in Yorkshire, or Ashgill Force in Cumberland, contrasted with the Fall of Lodore, near Keswick, are in this respect very instructive; nor should the cases be neglected where, as on the coast near Scarborough, Robinhood's Bay, and Whitby, the sea now flows among the lias and oolitic rocks, and wastes their argillaceous parts on a small scale, almost exactly as in the above explanation it is supposed to have wasted the similar but thicker clays, when the whole system was rising above the waves. Pleasing illustrations of this kind of action occur in the Medlock at Manchester, the Greta near Ingleton, the sea-coast near Heysham, Sunderland, Berwick, &c. In the

No. 7.

Valley of the Yore, near Hawes.



Isle of Wight the fresh-water limestones and clays, and the various beds of the plastic clay series about Culver, offer abundance of curious examples.

Forms of Hills.—The same mode of action is traced the forms of mountains and hills which are composed of strata of unequal resisting power; as mountain limestone and shale in the Yorkshire dales, oolite and clay in the Gloucestershire Hills, Normandy, or the Jura mountains.

The above diagram (No. 7) represents a cross-section of Wensley Dale, which for a great part of its length exhibits, wherever a considerable rock of limestone comes to the surface, a decided projection and terrace on the hill sid , and below every such rock a slope formed in the alternating shales and thin sandstones.

How much of this appearance is due to atmospheric action and rain since the river Yore has been running in its present bed, and how much to the influence of water bathing the hill-breasts at higher levels, is not easy to determine; but the correspondence of the strata on the opposite sides is such as to leave no doubt that all the vast space of the valley has been really excavated out of continuous strata; and the survey of the whole line of this and other rivers appears to refute the opinion that the existing drainage waters have carried off much of the detritus.

To conclude this brief notice of the origin of the principal inequalities on the earth's surface, it may be proper to remark that the view here given of the excavation of valleys, at the time of the rising of rocks from the sea, explains the otherwise unintelligible phænomenon of dry valleys in chalk, oolite, and other calcareous strata, which wind and unite like the branches of a river, and have slopes and features such as to prove their origin from moving water, but contain no trace of a stream, no mark of a spring, and often no alluvial sediment.

It appears also necessary to remark that, independent of the facts here stated, there must be some importance attached to the effects likely to be produced by the violent agencies, whatever they were, to which the origin of diluvial phænomena is ascribed. The essential thing however in this case being a relative change of level of land and sea, the result of the watery agitation could only be to modify in a greater or less degree the more considerable effects of previous agencies of longer duration. Gravel heaped in particular places conceals some of the earlier slopes of land, and covers with irregular hillocks an original sea-plain, but the great features of the country remain comparatively unaffected by these transient disturbances.

Life on the Globe.—Geology enables us to behold, in the present varied and complicated arrangement of land and water, the result of many and repeated actions of causes which are not yet extinct, but continually occupied in similar operations, in different situations, and under different circumstances. The land which has been raised from the sea by internal expansion seems to be slowly wasted away by the action of water, and again restored to the deep. But new land is formed by these ruins, and volcanic fires are yet competent to raise or depress the bed of the sea.

The land is not all of the same antiquity; some regions must have been covered by trees, perhaps or rather certainly traversed by quadrupeds, before the substance of others was laid on the bed of the sea. Since life was developed on the globe, if geology has rightly interpreted the monuments of nature, there has never been any considerable period during which the land or sea was wholly deprived of organic beings; but as the condition of the globe changed, the forms of life were altered, old races perished, new creations were awakened, the sum of animal and vegetable existence was continually augmented, and the variety of their forms and habits continually multiplied, as the ditions of land and sea were diversified, until man was added to the wonders of creation, and historic time began.

If then, through all past geological time, organic life has changed its aspect as physical conditions varied—if the present physical aspect of the globe is derived from previous physical revolutions, must we look on the present system of organic being, adapted to the present physical conditions, as similarly derived by corresponding revolutions from earlier systems of life, corresponding to earlier states of the land and sea?

If the physical aspect of the globe is now changing, does its organic enrichment vary likewise; or is the relation of organic life and physical condition one of coincidence merely—one of those adjustments independent in its nature, though associated in time and situation, which offer the most convincing proof of continual superintendence of the divine lawgiver of nature?

Though we cannot here enter at large on a subject which requires the details which are found under another head

[Organic Remains], there are points of too general importance, in reasoning on the present condition of the globe, to be wholly omitted: 1. The relation of form and structure between the living and extinct worlds of life; 2. The distribution of the existing forms of life, in reference to the geographical features and geological history of different parts of the globe.

The relation of living to extinct races of plants and animals is various. In point of number, the recent is perhaps 100 times as considerable as the fossil Flora, and though this is in some degree owing to the circumstance that land-plants, insects, &c., must necessarily be comparatively rare in marine strata, yet the vast number of individual plants accumulated in coal tracts does not appear to justify a very high estimate of the variety of specific forms of plants in early periods. The same is true f the marine races of shells, crustacea, fishes, &c.; for both the total number of species, and the relative number to a given thickness of strata, augment from the early towards the later formations, and are greatest of all in the tertiary strata, which in character of organic life most nearly resemble the modern productions of nature.

On comparing the living with the vanished tribes of plants and animals, we are struck with the fact that hardly one species of the fossil kingdom is so peculiar in its structure that nothing at all like it is now in existence. Recent analogies of extinct forms are continually and unexpectedly presented to us by the attentive voyagers who now explore the most remote and unknown regions of the land and sea, and continually revealed to us by the discoveries of comparative anatomy, which detects in common forms traces of analogies to extinct creations formerly altogether unsuspected. Thus the belemnite, the trilobite, the ichthyosaurus, are reduced to their proper station among mollusca, crustacea, and reptilia, and the whole extinct and living world of nature becomes united into one general system.

But this indubitable affinity between the plants and animals now living and those which adorned the world in earlier ages does not require us to adopt the speculations of Linnæus, Lamarck, and St. Hilaire, that specific forms of plants and animals are no further permanent than the circumstances which surround them: that as these change those vary; that the immense variety of organic structure may have been derived from a few primitive types—the living gavial from the fossil teleosaurus, the living cuttle from the fossil beleinnosepia, the living from the fossil equiseta. This doctrine, plausible as it seems, and flattering as it is to that propensity in man to derive everything from a beginning of which his own senses may give some notion, must be rejected for three reasons:—

1. In existing plants and animals the experience of mankind, for two or three thousand years, has shown no essential change.

2. There is no proof, drawn from examination of fossil reliquiæ, of this assumed change from one species to another, much less from one genus to another. On the contrary, it is a very striking truth, illustrated in almost every group of fossils, that while the same species retains through many deposits of different age its essential characteristics, new ones come into view in many of these strata, not by a gradual change, but by a sudden development.

3. The destruction of old races and the introduction of new appear in many cases to have been sudden and complete, at least locally.

In considering the distribution of existing forms of life, with reference to the geographical features and geological history of different parts of the globe, we cannot avoid being struck with the fact that each species, each genus, and often each family, of plants and animals, is especially abundant in and often exclusively confined to particular parts of the land or sea, even among those animals whose powers of locomotion are the greatest. Among fishes, birds, and swift quadrupeds, this attachment to locality is scarcely less remarkable than among plants, zoophytes, and mollusca, which have no means of diffusing their races, except what winds and currents give. It has therefore become an admitted truth in the philosophy of natural history, that there are certain regions of the land and tracts of the sea for which particular groups of plants and animals were specially created, and to which for the most part their existence is still confined.

The living species of plants and animals which most nearly resemble fossil races are variously distributed over the globe. Tree ferns, gigantic equisetaceæ, and other plants illustrative of the flora of the carboniferous period, may be found in Brazil, the Indian Islands, and Australia; coniferous plants occur in colder latitudes, or at greater heights in the tropics, as well as in the lias; cycadaceæ occur in South Africa and Australia, and tropical America, as well as in the oolites. The recent trigonia and cerithium giganteum are found on the Australian shore; pholadomya was washed on the island of Tortuga; and cucullæa belongs to the Indian Ocean. Lingula is found in the Moluccas; but terebratula in all seas: the nearest living form to the old fossil crocodiles inhabits the Ganges; while the bony pike, whose scales resemble those of megalichthys, lives in Lake Ontario.

Perhaps we ought to conclude from these facts that some particular regions of the globe still retain, in their climates and other circumstances, decided analogies to those earlier conditions which were once more general on the globe. In this point of view the comparison of recent and fossil animals and plants deserves to be much more prosecuted than it has been.

§ 8. Geological Time.

There is perhaps no more difficult problem in geology than the determination of the length of time which has elapsed during the formation of the whole or any definite part of the crust of the earth. Time, as measured by generations of men, fails to carry us back to remote geological epochs; man is but a recent visitor of the globe; compared even to the secondary strata his date is of yesterday, for *all* the existing forms of life cease with the lower tertiary rocks, only small proportions of them occur in the middle of that series, and traces of men have nowhere been seen in any but the most modern parts of the stratified masses of the globe. If then the history of the human race does not commence till after the deposition of at least the greater part of the tertiary strata, by what rules shall we attempt to compare the few thousand years of his existence with the earlier periods of the history of the globe?

In a vague sense, nothing appears more obvious than the conclusion universally admitted among geologists, that the earth is of vast antiquity, yet nothing more eludes the grasp of reasoning than the seemingly easy task of computing its age. The rocks are indeed full of monuments of time, 'rudera longinqui sensim præterlapsi ævi,' but we have not yet learned fully to decipher them.

When we behold thousands of strata piled on one another in a regular series, each distinct by some peculiarity from the others; when we find among these the original products of chemical action (as limestone), the slow sediments from gentle motion (clays), rough sand and pebbles implying greater agitation; how can we refuse to admit that long time elapsed during the often repeated change of chemical and mechanical agencies of water over the same portions of the bed of the sea?

When among these strata we observe the remains of plants and animals, various in their kinds, regular in their distribution, so as to prove that at successive times the same part of the sea nourished successive races of animals, and buried in its sediment distinct races of plants, where in modern nature is it conceivable that such repetitions of change, in all the ranks of creation, could take place except by the aid of almost immeasurable time?

Descending to minuter inquiries, we find some particular strata composed of fragments derived from a more antient rock, which after being deposited in water, was indurated, raised to the surface, wasted by drainage, and again collected in rolled fragments on the bed of another sea. The trees which are imbedded in certain rocks (coal-measures, lias, Portland oolite, &c.), are often known by their rings of growth to be some decads of years old, and in particular cases (Dirt-bed of the Isle of Portland) it is supposed that their whole life passed between the formation of two beds of stone.

Every country affords examples of certain fossil shells confined to even a thin layer of shale, sandstone, limestone, or ironstone, and in some instances (near Leeds and Bradford) the youngest embryo goniatite and the oldest full-grown shell (how much must we regret the want of means to state the full age of our recent mollusca!) are found in one bed of six or twelve inches' thickness, in that alone, and apparently in the place of their quiet existence, so as to indicate that the lifetime of that goniatite (G Listeri) was consumed during the accretion of one calcare-

ous bed, which is about $\frac{1}{5000}$th part of the thickness of the coal-measures whose history it enriches.

If again, among those strata produced by watery action we find alternations of volcanic rocks, and learn that at particular epochs in the series of deposits mountains were raised from the sea, land clothed with forests was submerged, and the physical geography of particular regions entirely changed, we see clearly that such repeated revolutions of nature agree with the history of the organic creations in refuting the narrow views of those who would limit the age of the world to the short annals of mankind.

But how are we to proceed further, so as to clothe with a more philosophical character these almost poetic notions of the immensity of past geological periods? Three orders of effects are in this respect important:—

1. The deposition of stratified rocks. 2. The changes of organic life on the land and in the sea. 3. The displacements of land and changes of physical geography.

The phænomena of stratification are at this day repeated, and on a very considerable scale, in most parts of the world. Where great rivers sweep earthy materials and vegetable reliquiæ to the sea, (Mississippi, Amazon, Rhine, Po, &c.,) littoral aggregations take place and new land is formed; tides and currents throw up sand-banks, or disperse the finer sediment far from shore over the quiet bed of the ocean. From the growth of new land on the Adriatic and Egyptian coasts, by the action of the Po and the Nile, some notion may be formed of the great quantity of sediment annually transported by rivers to the sea, and both reason and experience show that the materials are there accumulated in the same manner as the antient strata were.

But are they now accumulated with the same, with greater, or less rapidity? If equal deposits are now formed in equal times, the calculation of the age of the visible crust of the earth is as easy as it would be philosophically useless; but to assume this principle is to nullify the conclusion from it. Unless it can be shown, *à priori*, that atmospheric influence must have been constant through all past geological time, the assumption will not be accepte. This cannot be satisfactorily shown, for the external excitants on which the atmospheric actions depend have been proved to contain variable elements (§§ 3, 4). No certain conclusion then can be rested on the comparison of the mere thickness of the stratified rocks, as to the lapse of time, unless there can be found an independent scale of time which may help to interpret the other.

2. Such a scale of time is perhaps contained in the series of organic beings imbedded in the earth. These belong to many successive systems of life, which may be compared with the existing forms of nature, and could we establish from history any rate of change in organic life, any per centage of species destroyed, or created in a given series o. years, some considerable steps might be laid for further advance. But two or three thousand years appear to have made no change on quadrupeds, birds, reptiles, fishes, shells, or conspicuous plants. As far as can be known by study of old writers on natural history, sculptured monuments, coins, and mummies, no change of external form or internal structure has been experienced since the earliest historical æra; the loss of a very few species is all that can be safely admitted; and no proof is offered of a single newly-created form, though the distribution of the different groups of plants and animals has been varied by sea-currents carrying seeds and ova, and altered by man, who has learned to conquer by obeying nature.

As far therefore as the more obvious and characteristic forms of animals and plants can be admitted to yield satisfactory evidence, the period of two thousand years since the days of Aristotle would be insufficient even as a unit of measure by which to estimate the intervals of geological time which elapsed during the deposition of strata. This conclusion is strengthened by some and weakened by other considerations. It is weakened by the circumstance that the changes of organic life appear to have been sudden; it is fortified and illustrated in a powerful degree by comparing existing nature with the tertiary æra, for thus the five or more thousand shells of this day appear to be joined to an equal number of others, into one long series of definite organic forms, which, since the date of the chalk, have admitted new and lost old species continually. Whether these new species, in any particular basin of strata, were parts of one or more new creations there, or, as may perhaps be thought probable, transferred from ther centres of oceanic life, is quite unimportant for the rgument as to time. The effects resemble those noticed mong the older strata, the causes must be assumed to be correspondingly similar, and the times must be in some degree proportionate. Uniting therefore the tertiary and modern æras into one great geological period, we may compare the unknown quantity of time which it includes with other equally unknown and older intervals in the history of the globe, corresponding to similarly complete series of organic forms. This comparison is facilitated by the remarkable fact of the almost total distinctness of the organic beings of successive geological periods. Had the shells of successive systems of strata been gradually changed by substitution, we should have been compelled to compare not systems but formations, or even individual strata; and the conclusions might have become irremediably obscure.

The systems to be compared are:—Tertiary, Cretaceous, Oolitic, Saliferous, Carboniferous, Fossiliferous, Primary.

The following table, extracted from Professor Phillips's Guide to Geology,' 3rd edition, gives the proportionate thickness and number of organic forms of these systems:—

Strata.	General thickness.	Number of species of organic remains to 100 ft. thickness.
Tertiary	2000 ft.	141
Cretaceous	1100	70·7
Oolitic	2500	45·6
Saliferous	2000	8·2
Carboniferous	10,000	4·7
Primary	20,000	2·0

Hence it is very obvious that any conclusions as to time, drawn from the mere number of species which were developed and destroyed with any system of strata, will be totally opposed to others based on the observed thickness of the strata. The inferences are obvious and important; the numerical relations of organic life to the amount of stratified deposits are variable; one cannot be used as a measure of the other; the variety and abundance of organic life has been augmenting from the primary to the tertiary æras, or the deposition of strata was in the early ages of the world fifty times as rapid as in the tertiary period. This latter conclusion can never be allowed, since the fossiliferous primaries show clearly their origin from land-floods and littoral currents, and these depend on influences which cannot be supposed to have varied in any such proportion.

It thus appears that neither the numbers of organic fossils nor the thicknesses of strata afford a perfectly satisfactory scale by which to measure past geological time; but whichever of them be preferred, the age of the world cannot be estimated at less than several times the whole tertiary period, and compared with this the historical portion of time, which dates from the birth of man, contracts to a point.

By uniting the two considerations above stated, it will appear certain that the rate of organic development has been augmented, and probable that the rapidity of sedimentary deposition diminished since the primary æra; and it is no slight argument in favour of the hypothesis of a gradually cooling globe, that both these phænomena are natural consequences of it,—for that the greater influence of the earth's proper heat in the earlier epochs would favour the mechanical but limit the vital activity of nature seems to require no proof.

If however independent proof were required of this change of ratio among the agencies of nature, we must appeal to a third order of phænomena most certainly characteristic of disturbances of the equilibrium of the earth's proper temperature: the fractures, contortions, and other marks of the violent elevation and depression of the crust of the globe.

From what has been already stated it is very clear that the principal phænomena of this description occurred specially at particular intervals during the long periods of geology; for example, after the primary period, after the carboniferous æra, before and after the accumulation of the cretaceous strata, after many of the tertiaries were produced. Now on comparing the amount of disturbance effected at these epochs respectively we are unable to perceive that the efficient causes have diminished in force; for the elevation of the Alps in the tertiary period is apparently quite as conspicuous a phænomenon as can be found among older geological monuments. M. Elie de Beaumont, to whose speculation as to the geographical characters of subterranean movements allusion has already been made, supposes that as many as twelve distinct epochs of mountain-elevation may be recognised. The following is a brief sum-

mary of the classification which best suits the geology of England:—

Geological Period.	Effects noted.	Localities.
1. After the deposition of the Skiddaw Rocks.	Beds of argillaceous conglomerates.	Derwent Water.
2. During the deposition of the Snowdon Rocks.	Porphyry, greenstone, and trappean conglomerates.	Under Helvellyn, in Snowdon, &c.
*3. After all the primary strata were deposited.	Principal elevations of primary rocks.	Grampians, Lammermuirs, mountains of Cumberland and Wales.
Conglomerate rocks follow in the old red sandstone.		
*4. After the deposition of the coal strata.	Immense faults, anticlinal axes, &c.	The great faults of Tynedale, the Penine chain, Craven, Derbyshire, Flintshire, South Wales, and generally of the coal districts.
Conglomerates follow in the red sandstone.		
5. After the oolitic period.	Unconformity of stratification between oolite and chalk system.	Yorkshire, Dorsetshire.
*6. After the London clay.	Anticlinal axes and vertical strata.	Isle of Wight, Axis of the Wealden.

At the three epochs marked by stars, the most considerable movements and greatest changes in physical geography appear to have been produced. Such changes also occurred about the same epochs on the continent of Europe: the most universal of the phænomena seem to be the two earlier ones; but it is almost impossible in any case to prove that the occurrence of convulsions was synchronous at distant points. Since then we can neither affirm anything with respect to the change of force of the subterranean monuments at different geological epochs, nor can ascertain, except by reference to the phænomena of stratification and organic life, whether they occurred more frequently in one period than another, it is impossible to draw from the evidence of these disruptions any certain conclusion either as to the change of the earth's proper heat or the extent of geological time. If indeed the actual effects of earthquakes were to be placed against the mighty wall of the Penine fault, the vertical beds of the Isle of Wight, or the concealed dislocation of the coal-fields of Valenciennes, there would be no doubt of the decay of natural agencies; but this is not allowable, for the great dislocations alluded to are to be viewed as phænomena of a short interval of violent movements between long periods of ordinary action such as now obtains on the globe.

It may be supposed that the number of these cases of very great and extensive disturbance is in proportion to the time elapsed; but as none such has occurred within the reach of history for at least 4000 years, we see how very antient is the earth; and further, we have no data for accurately computing in numbers the vast periods which have elapsed in producing the stratified crust changing many times its vegetable and animal races. On the whole it appears that the day is not arrived for theory to trust itself with the attempt to assign definite values to the symbols of duration which remain in the earth. Long, undoubtedly, perhaps as long as the periods which the study of planetary motions has revealed, must be the whole range of geological time; but until we know at this day what is the average rate of deposition of sediment in the sea, or the usual age of marine mollusca, until we can determine the numerical or structural relations between organic forms and physical conditions, or can convert the irregular effects of volcanic fires into a calculable series of changes of temperature, there is little hope that the invitation of the Royal Society, to assign the antiquity of the crust of the earth, will be accepted by prudent and competent geologists.

§ 9. Economical Applications of Geological Science.

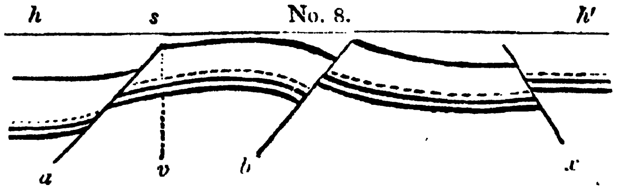
Practice, Mr. Whewell tells us, has ever been the nurse of theory: art has ever been the mother of science, the comely and busy mother of a daughter of far higher and serener beauty. But the benefits are reciprocal; geology, at least, is capable of well repaying the large debt which it owes to the experience of the miner, the engineer, and the agriculturist, and indeed some of its truths are already largely productive of public benefit.

Situation of Collieries.—There is hardly a district in this island where the reasoning of geology has not checked extravagant expenditure in search of coal or metallic ores where such are not to be found, and conquered the credulity of ignorance ever ready to listen to the delusive and almost superstitious notions of merely working colliers and miners. The false and deceitful promise of finding good coal by going deeper, will not often again lure the landed gentry and respectable companies to such adventures as sinking for coal in the oolites of Oxford the sandstones of Sussex, or the silurians of Radnorshire. But it is not merely by preventing foolish and wasteful expenditure, in search of imaginary treasures, that geology has aided the mining interest: it is within our memory that the eminent practical men of the great northern coal-fields doubted or denied even the existence of coal under the magnesian limestone. Yet now the Hetton colliery, and (in consequence of Mr. Wm. Smith's geological report in 1822) the South Hetton colliery, send enormous quantities of excellent coal to the London market from beneath the dreaded magnesian limestone. The almost universal prejudice of colliers that 'Red rock cuts off coal,' has been vanquished in Lancashire, Staffordshire, and Somersetshire, and reasons have been given by Conybeare and others for believing that under the red rocks of the midland counties great tracts of coal remain for the public advantage and the triumph of geology. (*Phil. Mag. and Annals.*)

Very recently, Lord Dartmouth, guided by geological reasoning, in opposition to the views of the local colliers, sunk a trial pit for coal near Birmingham, and found it below red sandstone rocks. It was faulty near the pit bottom, but this will not probably prevent the establishment of a valuable colliery, nor discourage further attempts in the vicinity.

Coal-working.—In the practical department of coal-working, geology can as yet render little aid, because the experience of the coal districts has never yet been turned into science. The subject of the 'faults' ('troubles,' as they are often and justly called), from which no coal-field is exempt, and which by their effects on subterranean drainage, and the disarrangement of the subterranean works, their influence on the quality of the coal, and other circumstances, are of the highest importance to the collier, is yet almost wholly unknown as a branch of science. One general fact known concerning them (the correspondence of the dip of the fault to the depression of the strata), may be illustrated in the subjoined diagram taken from Phillips's *Guide to Geology*, third edition, plate iv., fig. 13.

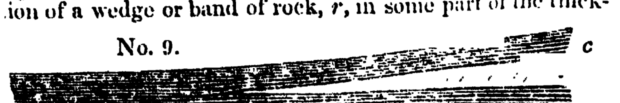
No. 8.



In this figure the faults *a*, *b*, and *x*, decline variously from the horizon *h h'*; and they are most frequently found to dip or decline under that portion of the divided strata which is relatively depressed, as *a* and *b*, not as *x*, which represents a rare and exceptional case. By the sides of faults the strata are often slightly or considerably bent, sometimes in the direction tending to unite their disrupted parts, as *a*; sometimes in the contrary way, as *b*. In the former case they are said to 'rise to an upthrow and dip to a downthrow;' in the latter they 'rise to a downthrow, and dip to an upthrow.' If these circumstances were carefully recorded by surveyors of collieries, science might eventually combine the detached facts into general laws, show their dependence on other conditions, and thus put an instrument of discovery into the hands of practical men.

It is a common thing to find valuable coal-beds at first injured, and ultimately rendered worthless, by the interposition of a wedge or band of rock, *r*, in some part of the thick-

No. 9.



ness of this coal; thus the High Main Coal of Newcastle is split, and in a particular direction ruined by the 'Heworth Band.' The upper part of the Great Staffordshire coal-beds goes off in 'the Flying Reed;' and the ten-feet bed of Barnsley in Yorkshire divides into almost unknown parts. If the details of colliery working were completely recorded (as for the public good they ought always to be), the law of these phænomena would perhaps be traced, so as to answer the

anxious questions which such intrusive bands suggest to coal proprietors.

The variations of quality in coal, whether of different beds in the same district (a common case), or of the same beds in different districts (as in South Wales, where good furnace coal is found in the east, and anthracitic coal abounds in the west), are not now known in a scientific form; and therefore science can give no help to practice. Nothing but the union of the parties interested in coal-working can furnish the data necessary for the establishment of general rules; and it is gratifying to find that one great district has set an example of such union, in the Geological Society of the West Riding of Yorkshire.

Situation of Mines, &c.—The beneficial results which mining operations have derived from geology are in proportion to the degree in which the experience of miners has been reduced to the form of science. On the subject of the situation of metallic treasures, already enough is known to show that the occurrence of mineral veins is a circumstance depending on conditions which are more or less ascertainable. For example, there is not, and perhaps has never been, in the British Isles, a single mine of any metal worked in any stratum more recent than the magnesian limestone; it is a general truth that rich veins of lead, copper, tin, &c., abound only in and near to districts which have been greatly shaken by subterranean movement; in Derbyshire, Alston Moor, Flintshire, and, in particular tracts, especially Cornwall and Devon, it is very apparent that near the great masses of granitic rocks the veins are most richly filled. The same facts are almost equally true on the continent of Europe, and in other parts of the world, though, occasionally, as in the Pyrenees, Auvergne, &c., the presence of igneous rocks may cause the exhibition of mineral veins in strata more recent than any of those which in England yield metallic ores.

In all cases where new mining ground is to be attempted, rules such as those above noticed are valuable; but even in districts partially known, or long worked, many problems occur which time and combined registration of phænomena observed might easily solve. These geological problems, as to the relation between the contents of a vein and the nature of the neighbouring rock, the occurrence of certain cross-veins, the depth of the workings, &c., usually present themselves to the practical miner under the general question of the probability of the vein being productive, and though the mining experience of 2000 years has been found insufficient to answer it, there appears no reason to doubt that it is capable of solution by the progress of geology. It is known that in a country of limestone, gritstone, and shale, equally broken by the same fissures, the former is generally most productive of lead (Alston Moor): that certain porphyritic rocks in Cornwall and Saxony appear directly influential on the deposits of particular metals; that argentiferous lead ore is more frequent in primary than in secondary strata; salts of lead more plentiful in the upper parts of veins (Lead Hills, Caldbeck Fells): but the precise nature of the connexion of the phænomena is yet a desideratum, and it will be long ere the dim and wavering light of experience can be replaced by the steady beams of the torch of science. (Von Duchen's *Handbuch*: Taylor's *Report to the British Association.*) [MINERAL VEIN.]

Engineering.—In planning the lines of railways, canals, or common roads, the engineer will often be benefited by the records of geological surveys. In looking at the geological map of England, for example, it must be evident to any one acquainted with the geographical characters of the different formations, that no canal can be made from London to the western or north-western counties without a tunnel or summit level on the chalk hills (as at the Kennet and Avon, between Wilton and Devizes, and on the Grand Junction, at Tring). The oolitic range of hills, with its basis of lias, presents a similar and parallel obstacle, conquered by tunnels on the Thames and Severn at Shepperton, the Oxford canal at Claydon, the Grand Junction at Braunston and Blisworth.

Since then these and other ranges of hills compel the formation of summit levels and tunnels, it is of importance that the whole of a country should be known to the engineer, as to its mineral structure as well as its elevation, in order that the situation of these may be properly fixed. It was inconvenient to make the Thames and Severn tunnel at its present level, often much above the level of the spring which is called the source of the Thames, and in the thirsty oolitic rocks; for thus the cost of maintaining the supply of water by puddling the canal, and engines for pumping, has been found very oppressive. Tunnels and summit levels for canals should certainly be made in argillaceous rocks, and geological investigations will often point out situations where, from particular displacements of the rocks, this is practicable, even in a range of hills so continuous and so calcareous as the chalk or the oolites.

The same rules do not apply to railroads, which on the contrary may often be beneficially carried through dry rocky hills which would absorb all the water of a canal.

In the execution of the works of canals and railroads, a good geological map would often be found more serviceable as a guide to the engineer than a great number of borings, unless these were placed in situations corresponding to the variations of the strata, which such a map would indicate.

Architecture.—In some favoured countries the labours of the sculptor and the architect are scarcely injured by exposure to the atmosphere for 2000 years; while in our damp and changeable climate, even the interiors of cathedrals show, by the decay of the marbles and the destruction of the stone walls the necessity for an architect to study the durability of his materials. It is remarkable that the Romans were more prudent or more fortunate in their choice of stone for buildings in Bath and York than their successors have been. The reliques in the Institution at Bath abundantly prove that the rag beds of the oolite are more durable than the finer and handsomer freestone, which the enterprise of Allen first introduced to common use. The magnesian limestone in the Roman walls of York is in far better condition of preservation than most of that which is of only half the age in the face of the cathedral.

The Saxons, in the north of England, used the coarse and durable millstone grit, which on the brows of the high mountains of Derbyshire and Yorkshire stands conspicuous for its bold defiance to the elements. In choosing from any given rock the parts which are most fitted for permanent edifices, the examination of nature is perhaps more instructive than even a study of buildings. Not every sort of granite resists the carbonic acid and moisture of the air; but while the rolled blocks from Shap-fell retain, after thousands of years' exposure on the surface, their surfaces of attrition, the granitic top of Castle Abhol, in Arran, is so rotten that it may be easily beaten to fragments by a hammer. The millstone grit of Brimham is almost wasted away over a hundred acres, while that of Agra Crags appears to be more cap[able] of withstanding the same agencies; and the druidic... of Boroughbridge have stood the storms of 2000 years, with little more injury than a few rain-channels which scarcely reach the ground.

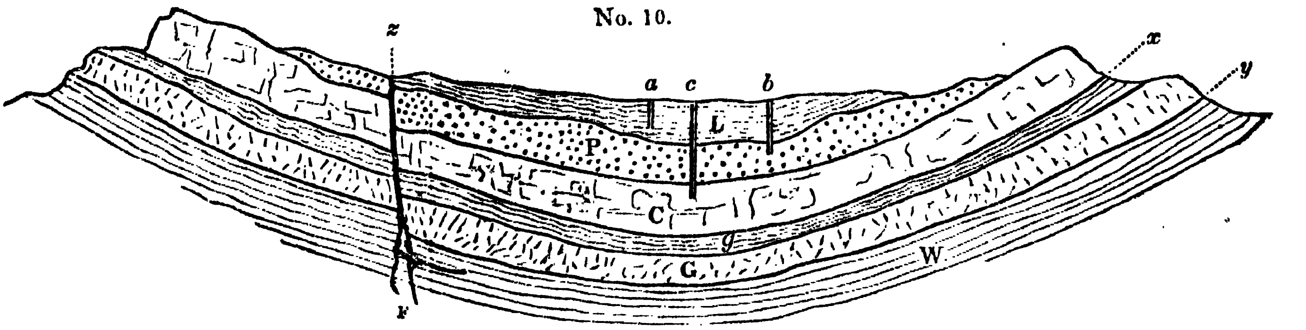
Supply of Water, Draining, &c.—To the agriculturist geology has rendered some services, and probably may in future be appealed to for further aid. Lister's proposal for the construction of a map of soils was only partially executed, after a century, in some of the county reports made to the Board of Agriculture. The principal use, as it appears to us, of such a map (and this is in fact supplied by the maps of strata), is to aid the statistics of agriculture by furnishing a basis for comparing the agricultural practices on similar and dissimilar soils.

But geological science will appear more intimately connected with agricultural improvements if we consider it as the basis of all sound knowledge of springs and the subterranean distribution of water. The rain which falls from the heavens upon all soils and rocks indifferently runs off the clays, but sinks into the limestones, sandstones, and other rocks, whose open joints act like so many hidden reservoirs; owing to the complicated intercommunication of the fissures, these reservoirs are slowly filled and slowly emptied; both the supply from rain and the discharge from springs may and generally do go on together, and the jointed rocks may be viewed as equalizing the supply and expenditure.

But below the level of the springs thus formed a great body of water exists in the deeper parts of the earth, and in fact fills the whole space left by fissures in the rocks, unless where, as in diag. No. 10, there be a fault which breaks the continuity of the communications along the rocks. At .... surface there will be generally one or more springs (z) along the line of such a fault, F.

In sinking deep pits it is generally found that argillaceous strata are quite dry within; for example, in the diagram

No. 10.



a, b, c, Wells. L, London clay. P, plastic clay and sands. C, chalk. *g*, gault. G, lower green sand. W, wealden. *x, y, z*, springs; the last at a fault, F.

above referred to, the well *a*, supposed to be sunk in the London clay, yields no water; but the other strata, alternating with the clays, yield water in greater or less quantity, and of quality corresponding to the nature of the rock. Thus the well *b*, sunk down to the sands, lignites, &c. of the plastic clay, yields some water, not always of good quality; but when the well, as *c*, is made to reach to and penetrate the chalk, a great body of good water commonly rises from that rock. The illustrations of this and other phænomena relating to subterranean drainage already given under the head Artesian Well, may be consulted for further information.

To drain land is to intercept the natural springs: this can never be done upon good principles unless the geological structure of the district be known. When porous rocks alternate with strata impervious to water, the springs will commonly issue at several points on the surface line of junction of the strata, as at *x* and *y* in diag. No. 10; and, by making a deep drain along the line of junction, Dr. Smith has often accomplished the complete desiccation of wet lands in the oolitic districts of England, which had been in vain guttered in all directions by the usual hollow drains.

The same principle applies, but not with the same ease or success, to the draining of districts where gravel and clay are much intermingled. The gravel acts as a porous rock, but its irregular distribution renders the operation of deep draining costly and less effectual.

From the same principles it follows that springs may be regulated, and the subterranean reservoirs employed to store up water in winter, when it is little wanted, for the purpose of supplying the demand in summer. This has actually been done by Dr. W. Smith, who opened, in the sandstone rocks near Scarborough, a subterranean reservoir on the site of a little spring, closed it with a dam, and regulated the discharge for the benefit of the town. (*Phil. Mag.*, 1827.) See for further details the article Springs.

GEO'METER, a person who is skilled in geometry; but the term derives its meaning from the time when geometry was by very much the most important branch of mathematics, and now it generally means mathematician. For instance, the French (who make considerable use of the term) call Laplace *un géomètre*, though his writings are exclusively algebraical. The term must then be understood to signify simply mathematician.

GEOMETRICAL. Of this term as opposed to algebraical or arithmetical, nothing need be said; but the peculiar conventions of geometry oppose it most frequently to the term *mechanical*. Every construction which can be made by the ruler and compasses; that is, which demands no points except such as can be found by the intersections of straight lines and circles, is *geometrical*: every construction which requires any other curve, or which tacitly requires such a motion of a straight line or circle as would generate any other curve, is *mechanical*. The reason is that it pleased the Greeks to use these terms as distinctive of the things which can and cannot be done by the straight line and circle only: a real and important distinction with an unfortunate name. For though names, when clearly understood, are of little consequence, yet this convention of geometry has caused many to waste their time and misapply their talents. A man for instance not well versed in mathematics, hearing that a *geometrical* quadrature of the circle has long been sought, and never been found, sets his invention to work, easily discovers a (mechanical) method of proceeding, and imagines that everything is geometrical which employs lines, solids, &c., in space.

The conic sections were not considered by the Greeks as geometrical instruments. Several writers speak as though the contrary had been the case; but it is certain that the solution by Menechmus of the problem of two mean proportionals, which employs the parabola, was not considered by Eutocius (who records it) as more geometrical than the others which he gives.

GEOMETRICAL PROPORTION, PROGRESSION, &c. [Proportion; Progression; &c.]

GEOMETRY (γεωμετρία, *geométria*, or land-measurement), the science which investigates the relations existing between parts of space, whether linear, superficial, or solid. But at the same time, the most common meaning of the word implies that the investigation is to take place under restrictions as to the instruments which may be employed. Of this we shall see more when we come to the Geometry of the Greeks; in the meanwhile, geometry may be generally defined as the science of space.

As geometry is in all probability the most antient subject to which actual demonstration was applied, we may thus account for the permanent association which has always existed between the idea of this science and that of rigorous deduction. To reason geometrically is a synonyme for to reason strictly: but abandoning this particular view of geometry to the article Logic, &c., we shall devote the present article principally to such an imperfect sketch of the early progress of the science as its meagre history, combined with the narrowness of our limits, will allow.

There is a *stock history* of the rise of geometry, supported by the names of Strabo, Diodorus, and Proclus, namely, that the Egyptians, having their landmarks yearly destroyed by the rise of the Nile, were obliged to invent an art of land-surveying in order to preserve the memory of the bounds of property; out of which art geometry arose. This story, combined with another attributing the science directly to the gods, forms the first light which we have on the subject, and both in one are worthily sung by the poet who figures at the head of an obsolete English course of mathematics—

> 'To teach weak mortals property to scan,
> Down came geometry and formed a plan.'

There is no proof whatever that the Egyptians were more of geometers than of astronomers [Astronomy], and the supposition that the rise of the Nile obliged the builders of the pyramids to make new landmarks once a year, requires at least contemporary evidence to make it history. At the same time, the question of the actual origin of geometry is a very difficult one, and any conclusion can only be of very moderate probability.

Among the Chinese, the Jesuit missionaries found very little knowledge of the properties of space: a few rules for mensuration and the famous property of the right-angled triangle being all that they could ascertain. Of all the books which Gaubil could find professing to be written before B.C. 206 there is only one which contains anything immediately connected with geometry. From this writing (called Tcheou-pey) it is not very certain whether the Chinese possessed the property of the right-angled triangle generally, or only one particular case; namely, when the sides are as 3, 4, and 5: and nothing appears which directly or indirectly resembles demonstration. The Hindoos produce a much larger body of knowledge, but of uncertain date. The works of Brahmegupta and Bhascara, of the seventh and twelfth centuries of the Christian æra (according to Colebrooke), contain a system of arithmetical mensuration which is certainly older than the compilers mentioned, and in which the property of the right-angled triangle is made to produce a considerable number of results; for instance, the method of finding the area of a triangle of which the three sides are given. By a figure

drawn on the margin of some manuscripts, it appears that a demonstration of the property in question had been obtained. [HYPOTHENUSE.] The circumference of the circle is given as bearing to the diameter the proportion of 3927 to 1250 by the later writer; being exactly that of 3·1416 to 1. Brahmegupta takes the proportion of the square root of 10 to 1, or 3·16 to 1. The superior correctness of the later writer could not have arisen from any intermediate communication with Europe, since the true ratio was not known so near as 3·1416 till after the twelfth century: and the Persians (as appears by the work of Mohammed ben Musa) had adopted this ratio from the Hindus, before the discovery of an equally exact ratio in Europe. We shall enter into more detail on this subject in the article VIGA GANITA, merely observing that though no date can be fixed to the commencement of geometry in India, yet the certainty which we now have that algebra and the decimal arithmetic have come from that quarter, the recorded visits of the earlier Greek philosophers to Hindustan (though we allow weight rather to the tendency to suppose that philosophers visited India, than to the strength of the evidence that they actually did so), together with the very striking proofs of originality which abound in the writings of that country, make it essential to consider the claim of the Hindus, or of their predecessors, to the invention of geometry. That is, waiving the question whether they were Hindus who invented decimal arithmetic and algebra, we advance that the people which first taught those branches of science is very likely to have been the first which taught geometry; and again, seeing that we certainly obtained the former two either from or at least through India, we think it highly probable that the earliest European geometry also came either from or through the same country.

Of the Babylonian and of the Egyptian geometry we have no remains whatever, though each nation has been often said to have invented the science. In reference to the authorities mentioned above in favour of the Egyptians, to whom we may add Diogenes Laertius, &c., we may say that no one of the writers who tells the story in question is known as a geometer except Proclus, the latest of them all; and as if to give the assertion the character of an hypothesis, this last writer also adds that the Phenicians, on account of the wants of their commerce, became the inventors of arithmetic. In the Jewish writings there is no trace of any knowledge of geometry. So that allowing the Greeks to have received the merest rudiments either from Egypt or India, or any other country, it is impossible to name any quarter from which we can with a shadow of probability imagine them to have received a deductive system, to ever so small an extent. That their geometry, or any of it, came *direct* from India, is a supposition of some difficulty: those who brought it could hardly have failed to bring with it the decimal notation of arithmetic. That Pythagoras travelled into India, is (according to Stanley) only the assertion of Apuleius and Clemens Alexandrinus, though rendered probable by several of his tenets.

Thales (600 B.C.) and Pythagoras (540 B.C.) founded the earliest schools of geometry. The latter is said to have sacrificed a hecatomb when he discovered the property of the hypothenuse before alluded to; and this silly story is repeated whenever the early history of geometry is given. A large collection of miscellanies might easily be made from the works of writers who were not themselves acquainted with geometry; but, rejecting such authorities, we shall content ourselves with citing Pappus and Proclus, both geometers, who, living in the fourth and fifth centuries after Christ, had abundant opportunities of hearing the stories to which we allude, and of receiving or rejecting them.

According to Proclus (book ii. ch. 4, *Comm. in Eucl.*) Pythagoras was the first who gave geometry the form of a science, after whom came Anaxagoras, Œnopides, Hippocrates of Chios (who invented the well known quadrature of the lunules), and Theodorus of Cyrene. Plato was the next great advancer of the science, with whom were contemporary Leodamas, Archytas, and Theætetus, of Thasus, Tarentum, and Athens. After Laodamas came Neoclides, whose disciple Leo made many discoveries, added to the accuracy of the elements, and gave a method of deciding upon the possibility or impossibility of a problem. After Leo came Eudoxus, the friend of Plato, who generalized various results which came from the school of the latter. Amyclas, another friend of Plato, and the brothers Menæchmus and Dinostratus made geometry more perfect. Theudius wrote excellent elements, and generalized various theorems. Cyzicinus of Athens cultivated other parts of mathematics, but particularly geometry. Hermotimus enlarged the results of Eudoxus and Theætetus, and wrote on *loci*. Next is mentioned Philippus, and after him Euclid, 'who was not much younger than those mentioned, and who put together elements, and arranged many things of Eudoxus, and gave unanswerable demonstrations of many things which had been loosely demonstrated before him.' He lived under the first Ptolemy, by whom he was asked for an easy method of learning geometry, to which he made the celebrated answer, that there was no royal road. He was younger than the time of Plato, and older than Eratosthenes and Archimedes. He was of the Platonic sect.

Such is, very nearly entire, the account which Proclus gives of the rise of geometry in Greece.

Before the time of Euclid demonstration had been introduced, about the time, perhaps by the instrumentality, of Pythagoras; pure geometry had been restricted to the right line and circle, but by whom is not at all known; the geometrical analysis, and the study of the conic sections, as also the consideration of the problems of the duplication of the cube, the finding of two mean proportionals, and the trisection of the angle, had been cultivated by the school of Plato; the quadrature of a certain circular space had been attained, and the general problem suggested and attempted by Hippocrates and others; a curve of double curvature had been imagined and used by Archytas; writings existed both on the elements, and on conic sections, loci, and detached subjects. It is in this part of the present article that we have judged it best to introduce what would otherwise have formed the article EUCLID OF ALEXANDRIA. A writer who has given his own name to a science cannot be treated of in any other place than its history.

It is not known where Euclid was born. He opened a school of mathematics at Alexandria, in the reign of Ptolemy the son of Lagus (323—284 B.C.), from which school came Eratosthenes, Archimedes, Apollonius, Ptolemy, the Theons, &c. &c., so that from and after Euclid the history of the school of Alexandria is that of Greek geometry. He was, according to Pappus, of a mild and gentle temper, particularly towards those who studied the mathematical sciences: but Pappus is too late an authority for the personal demeanor of Euclid, and moreover may have been incited to praise him for the purpose of depreciating Apollonius, of whom he is then speaking, and against whom he several times expresses himself. Besides the Elements, Euclid wrote, or is supposed to have written, the following works:—

1. Σύγγραμμα Ψευδαρίων, a treatise on Fallacies, preparatory to geometrical reasoning. This book, mentioned by Proclus, does not now exist, and there is no Greek work of which we so much regret the loss. Had it survived, mathematical students would not have been thrown directly upon the Elements, without any previous exercise in reasoning. [MATHEMATICS.]

2. Four books of Conic Sections, afterwards amplified and appropriated by Apollonius, who added four others. So says Pappus, as already mentioned in APOLLONIUS PERGÆUS. That Euclid did not write these books, appears to us more than probable from the silence of Proclus the Platonist, who, eulogizing Euclid the Platonist, and stating that he wrote on the regular solids (a part of geometry cultivated by the Platonists), being led thereto by Platonism, never mentions his writing on the still more Platonic subject of the conic sections. But that Aristæus had written on the subject is known, and that Euclid taught it cannot be doubted, any more than that Apollonius, like other writers, prefixed to his own discoveries all that he judged fit out of what was previously known on the subject.

3. Περὶ Διαιρέσεων, on Divisions. This work is mentioned by Proclus in two words. John Dee imagined the book of Mohammed of Bagdad (which is annexed to the English edition of Euclid hereinafter cited) on the division of surfaces to be that of Euclid now under consideration; but there seems to be no ground for this notion. The Latin of this work (from the Arabic) is given at the end of Gregory's Euclid, together with a fragment 'De Levi et Ponderoso,' attributed, without any foundation, to Euclid.

4. Περὶ πορισμάτων, on Porisms, in three books. This is mentioned both by Pappus and Proclus, the former of whom gives the enunciations of various propositions in it, but the text is so corrupt that they can hardly be understood. On this singular question, see the article PORISM.

5. Τόπων πρὸς ἐπιφάνειαν, Locorum ad Superficiem: which we cannot translate. It is mentioned by Pappus, but has not come down to us.

The preceding works are either lost or doubtful; those which follow all exist, and are contained in Gregory's edition, in the order inverse to that in which they are here mentioned.

6. Ὀπτικὰ καὶ κατοπτρικά, on Optics and Catoptrics. These books are attributed to Euclid by Proclus, and by Marinus in the preface to the Data; or rather books on these subjects. Savile, Gregory, and others doubt that the books which have come down to us are those of Euclid, and Gregory gives his reasons in the preface, which are—that Pappus, though he demonstrates propositions in optics and also in astronomy, and mentions the Phænomena of Euclid with reference to the latter, does not mention the Optics with reference to the former—and that there are many errors in the works in question, such as it is not likely Euclid would have made. Proceeding on the supposition that rays of light are carried *from the eye to the object*, the first of these books demonstrates some relations of apparent magnitude, and shows how to measure an unknown height by the well-known law of reflected light. In the second an imperfect theory of convex and concave mirrors is given.

7. Φαινόμενα, on Astronomical Appearances, mentioned by Pappus, and Philoponus (cited by Gregory). It contains a geometrical doctrine of the sphere, and though probably much corrupted by time, is undoubtedly Euclid's.

8. Κατατομὴ κανόνος and εἰσαγωγὴ ἁρμονική, the Division of the Scale and Introduction to Harmony. Proclus mentions that Euclid wrote on harmony, but the first of these treatises is a distinct geometrical refutation of the principles laid down in the second, which renders it unlikely that Euclid should have written both. The second treatise is Aristoxenian [Aristoxenus], while the first proceeds on principles of which Gregory states he never found a vestige in any other writer who was reputed anterior to Ptolemy (to whom he attributes it). The second treatise is not geometrical, but is purely a description of the system mentioned, and as this treatise is not alluded to by Ptolemy nor by any previous writer on the subject, it is very probable that Euclid did not write it.

9. Δεδομένα, a Book of Data. This is the most valuable specimen which we have left of the rudiments of the geometrical analysis of the Greeks. Before a result can be found, it should be known whether the given hypotheses are sufficient to determine it. The application of algebra settles both points; that is, ascertains whether one or more definite results can be determined, and determines them. But in geometry it is possible to propose a question which is really indeterminate, and in a determinate form, while at the same time the methods of geometry which give one answer may not give the means of ascertaining whether the answer thus obtained is the only one. Thus the two following questions seem equally to require one specific answer, to one not versed in geometry:—

Given, the area of a parallelogram, and the ratio of its sides; required, the lengths of those sides: and

Given, the area of a parallelogram, the ratio of its sides and one of its angles; required, the lengths of the sides.

The first question admits of an infinite number of answers, and the second of only one; or, in the language of Euclid, if the area, ratio of sides, and an angle of a parallelogram be given, the sides themselves are given. The same process by which it may be shown that they are given serves to find them; so that the Data of Euclid may be looked upon as a collection of geometrical problems, in which the attention of the reader is directed more to the question of the sufficiency of the hypothesis to produce one result, and one only, than to the method of obtaining the result.

A preface to this book was written by one Marinus, the disciple and successor of Proclus, explaining at tedious length the distinction of 'given' and 'not given.'

10. Στοιχεῖα, the Elements (of Geometry). For a long time writers hardly considered it necessary to state whose elements they referred to, since a certain book of the elements always signified that book of Euclid: and it was customary in England to call each book *an* element: thus in Billingsley's old translation the sixth book is called *the sixth element*.

The reason why the Elements have maintained their ground is not their extreme precision in the statement of what they demand [Axiom]; for it frequently happens that a result is appealed to as self-evident, which is not to be found in the expressed axioms. Neither does their fame arise from their never assuming what might be proved; for in the very definitions we find it asserted that the diameter of a circle bisects the figure, which might be readily proved from the axioms. Neither is it the complete freedom from redundancy, nor the perfection of the arrangement; for book i. prop. 4, which is very much out of place, considering that it is never wanted in the first book, is, in point of fact, proved again (though not expressed) in prop. 19. Neither is it the manner in which our ideas of magnitude are rendered complete, as well as definite: for instance, book iii. prop. 20, is incomplete with Euclid's definition and use of the term angle; nor with that term as used by him can the 21st proposition of that book be fully demonstrated without the help of the subsequent 22nd. In fact, the Elements abound in defects, which, if we may so speak, are clearly seen by the light of their excellencies: the high standard of accuracy which they inculcate in general, the positive and explicit statement which they make upon all real and important assumptions, the natural character of the arrangement, the complete and perfect absence of false conclusion or fallacious reasoning, and the judicious choice of the demonstrations, considered with reference to the wants of the beginner, are the causes of the universal celebrity which this book has enjoyed. We shall, in the article Mathematics, give our reasons for advocating the continuance of Euclid as a book of instruction, and shall now describe the contents of the Elements.

There are thirteen books certainly written by Euclid, and two more (the fourteenth and fifteenth) which are supposed to have been added by Hypsicles of Alexandria (about 170 A.D.).

Book i. lays down the definitions and postulates required in the establishment of plane geometry, a few definitions being prefixed also to ii., iii., iv., and vi. It then treats of such properties of straight lines and triangles as do not require any particular consideration of the properties of the circle nor of proportion. It contains the celebrated proposition of Pythagoras.

From this book it appears that Euclid lays down, as all the instrumental aid permitted in geometry, the description of a right line of indefinite length, the indefinite continuation of such a right line, and the description of a circle with a given centre, the circumference of which is to pass through a given point. It is usual to say, then, that the rule and compasses are the instruments of Euclid's geometry, which is not altogether correct, unless it be remembered that with neither ruler nor compasses is a straight line allowed to be transferred, of a given length, from one part of space to another. It is a plain ruler, whose ends are not allowed to be touched, and compasses which close the moment they are taken off the paper, of which the Greek geometry permits the use. It is altogether uncertain by whom these restrictive postulates were introduced, but it must have been before the time of Plato, who was contemporary with (if he did not come after) the introduction of those problems whose difficulty depends upon the restrictions. We may here observe that in actual construction the ruler might have been dispensed with. It was reserved for an Italian abbé, at the end of the eighteenth century, when all who studied geometry had, for two thousand years, admired the smallness of the bases on which its conclusions are built, to inquire whether, small as they were, less would not have been sufficient. In Mascheroni's 'Geometria del Compassa,' published at Pavia in 1797, it is shown that all the fundamental constructions of geometry can be made without the necessity of determining any point by the intersections of straight lines; that is, by using only those of circles. This singular and very original work was translated into French, and published at Paris in 1798 and 1828.

On subjects particularly connected with the first book, see Axiom, Postulate, Parallels, Hypothenuse.

Book ii. treats of the squares and rectangles described upon the parts into which a line is divided. It opens the way for the application of geometry to arithmetic, and ends by showing how to make a rectangle equal to any rectilinear figure. It also points out what modification the proposition of Pythagoras undergoes in the case of a triangle not right-angled. [Rectangle.]

Book iii. treats of the circle, establishing such properties as can be deduced by means of the preceding books.

Book iv. treats of such regular figures as can readily be described by means of the circle only, including the pentagon, hexagon, and quindecagon. It is of no use in what immediately follows.

Book v. treats of proportion generally, that is, with regard to magnitude in general. Whether this most admirable theory, which though abstruse is indispensable, was the work of Euclid himself, or a predecessor, cannot now be known. The introduction of any numerical definition of proportion is rendered inaccurate by the necessity of reasoning on quantities between which no exact numerical ratio exists; for which see INCOMMENSURABLES. The method of Euclid avoids the error altogether, by laying down a definition which applies equally to commensurables and incommensurables, so that it is not even necessary to mention this distinction. In the article PROPORTION we shall endeavour to show that this method is more simple than is generally supposed, and also that all substitutes for it have failed in rigorous deduction.

Book vi. applies the theory of proportion to geometry, and treats of similar figures, that is, of figures which differ only in size, and not in form.

Book vii. lays down arithmetical definitions; shows how to find the greatest common measure and least common multiple of any two numbers; proves that numbers which are the least in any ratio are prime to one another, &c.

Book viii. treats of continued and mean proportionals, showing when it is possible to insert two integer mean proportionals between two integers.

Book ix. treats of square and cube numbers, as also of *plane* and *solid* numbers (meaning numbers of two and three factors). It also continues the consideration of continued proportionals, and of prime numbers, shows that there is an infinite number of prime numbers, and demonstrates the method of finding what are called *perfect* numbers.

Book x. contains 117 propositions, and is entirely filled with the investigation and classification of incommensurable quantities. It shows how far geometry can proceed in this branch of the subject without algebra; and though of all the other books it may be said that they remain at this time as much adapted for instruction as when they were written, yet of this particular book it must be asserted that it should never be read except by a student versed in algebra, and then not as a part of mathematics, but of the history of mathematics. In the article IRRATIONAL QUANTITIES we shall translate the phrases of Euclid into algebraical language, by means of which we have no doubt that many students will be enabled to read the book of Euclid with profit. The book finishes with a demonstration that the side and diagonal of a square are incommensurable. From this book it is most evident that the arithmetical character of geometrical magnitude had been very extensively considered; and it seems to us sufficiently clear that an arithmetic of a character approximating closely to algebra must have been the guide, as well as that some definite object was sought—perhaps the attainment of the quadrature of the circle.

Book xi. lays down the definitions of solid geometry, or of geometry which considers lines in different planes and solid figures. It then proceeds to treat of the intersections of planes, and of the properties of parallelopipeds, or what might be called solid rectangles.

Book xii. treats of prisms, cylinders, pyramids, and cones, establishing the properties which are analogous to those of triangles, &c., in the first and sixth books. It also shows that circles are to one another as the squares on their diameters, and spheres as the cubes on their diameters, in which, for the first time in Euclid, the celebrated METHOD OF EXHAUSTIONS is employed, which, with the theory of proportion, forms the most remarkable part of this most remarkable work. In the article just cited we have referred to the present one for some account of this method, which we now give.

The only method of reasoning upon the length, area, or solidity of curve lines or surfaces, is by observing the properties of inscribed polygons, which may, by sufficiently increasing the number of their sides or faces, be made to approach as near as we please to continued curvilinearity. But since the rigour of geometry is not content with proving that a proposition may be considered as nearly true as we please, and will not infer that one line is equal to another because it can be shown that their difference is (no matter how) small; Euclid (or some of his predecessors, but most probably Euclid, if we may judge by the character of his discoveries given by Proclus) invented this method of exhaustions, which may be considered as contained in two propositions.

I. If from A more than its half be taken, and from the remainder more than its half, and so on, the remainder will at last become less than B, where B is any magnitude named at the outset (and of the same kind as A), however small. This proposition may be easily proved, and is equally true if the proportion abstracted each time be half or less than half.

II. Let there be two magnitudes, P and Q, both of the same kind: and let a succession of other magnitudes, called X_1, X_2, X_3... be each nearer and nearer to P, so that any one, X_n, shall differ from P less than half as much as its predecessor differed. Let Y_1, Y_2, Y_3... be a succession of quantities similarly related to Q; and let the ratios of X to Y_1, of X_2 to Y_2, and so on, be all the same with each other, and the same with that of A to B. Then it must be that P is to Q as A to B. (It is obvious, from the conditions, that if X_1 be greater than P, Y_1 is greater than Q, &c., &c.) Suppose X_1, X_2, &c., less than P, and therefore Y_1, Y_2, &c., less than Q. Then if A is not to B as P to Q, A is to B as P to some other quantity S greater or less than Q: say less than Q. Then (by hyp. and I.) we can find some one of the series Y_1, Y_2... (say Y_n) which is nearer to Q than S is to Q; and which is therefore greater than S. Then since X_n is to Y_n as A to B, or as P to S, we have X_n is to Y_n as P to S, or X_n to P as Y_n to S: from which, since X_n is less than P, Y_n is less than S. But Y_n is also greater than S, which is absurd; therefore A is not to B as P to less than Q. Neither is A to B as P to more than Q (which call S) for in that case S is to P as B to A: let S be to P as Q to T, then S is to Q as P to T; from which, S being greater than Q, P is greater than T. But B is to A as S to P, that is, as Q to less than P, which is proved to be impossible by the reasoning of the last case. Consequently, A is not to B as P to more than Q, or to less than Q; that is, A is to B as P to Q. Which was to be shown. Let P and Q be two circles, A and B the squares on their diameters, X_1 and Y_1 inscribed squares, X_2 and Y_2 inscribed regular octagons, X_3 and Y_3 inscribed regular figures of sixteen sides, &c.: the preceding process gives the proof that circles are to one another as the squares on their diameters.

Book xiii., the last of those written by Euclid, applies some results of the tenth book to the sides of regular figures, and shows how to describe the five regular bodies. [SOLIDS, REGULAR.]

Books xiv. and xv., attributed to Hypsicles of Alexandria, treat entirely of the relative proportions of the five regular solids, and of their inscription in one another.

The writings of Euclid continued to be the geometrical standard as long as the Greek language was cultivated. The Romans never made any progress in mathematical learning. Boethius [BOETHIUS] translated, it is said, the first book of Euclid (Cassiodorus, cited by Heilbronner), but all which has come down to us on the subject from this writer (who lived at the beginning of the sixth century) is contained in two books, the first of which has the enunciations and figures of the principal propositions of the first four books of the Elements, and the second of which is arithmetical. Some of the manuscripts of this writer contain an appendix which professes to give an account of a letter of Julius Cæsar, in which he expresses his intention of cultivating geometry throughout the Roman dominions. But no such result ever arrived as long as the Western Empire lasted; and this short account of Roman geometry is a larger proportion of the present article than the importance of the subject warrants. These books of Boethius continued to be the standard text books until Euclid was brought in again from the Arabs.

Among the last-mentioned race geometry made no actual progress, though many of the works of the Greek writers were translated, and Euclid among the rest. There are several Arabic versions, the most perfect of which is that of Othman of Damascus, who augmented the usual imperfect translations by means of a Greek manuscript which he saw at Rome. D'Herbelot (at the words Aklides and Oclides) states that the Orientals believe Euclid to have been a native of Tyre, and also that they frequently gave his name to the science which he taught. The same author gives the names of the Arabic versions, one of which, that of Nasir eddin, the most celebrated of all, was printed

at the Medicean press at Rome in 1594. The astronomer Thabet ben Korrah [ASTRONOMY] was one of the translators, or rather, perhaps, revised the translation of Honeir ben Ishak, who died A.D. 873. There is a manuscript in the Bodleian Library, purporting to be the translation of the latter edited by the former.

The first translation of Euclid into Latin, of which the date can be tolerably well fixed, is that of Athelard, or Adelard, a monk of Bath, who lived under Henry I. (about A.D. 1150). We have given [CAMPANUS] a summary of authorities to show that Campanus, supposed to be another translator of Euclid, lived after this period; but we are inclined to believe that this translation (so called) of Campanus (printed A.D. 1482), is in fact that of Athelard, with a commentary by Campanus. For Campanus is not expressly described in the book as a translator (see article cited), but as a commentator; add to which, that there is in the Bodleian Library a manuscript entitled 'Euclidis, &c., ex versione Adelardi de Arabico, una cum commento Magistri Campani Novariensis.' Scheibel (cited by Camerer and Hauber, in the preface of their edition, presently noticed) states that in his copy of Campanus the fact of the translation being that of Adelard was noted in a handwriting apparently as old as the edition itself. The point might be settled by a comparison of the printed Campanus and the manuscript in the Bodleian. With regard to this version, it is stated (in the preface just cited) that it differs from the one of Nasireddin. With the precedent just cited, we may be allowed to state that in a copy of Campanus which we have examined, some antient handwriting, completely obliterated, is attached to Ratdolt's preface. Chemical means have succeeded in recovering a few unconnected words only, among which are 'ben Honein' and 'Tebit ben Corra,' expressing perhaps the opinion of the writer that the version chosen by Adelard or Campanus was that of the two Eastern editors who have been previously mentioned.

There is a considerable number of Greek manuscripts of the Elements, for which see Fabricius and Heilbronner. There is no account of the manuscripts which they consulted by the earlier Latin translators (from the Greek), nor by Gregory. It appears however that several, if not many, of the manuscripts are entitled Εὐκλείδου στοιχείων βιβλία ιε ἐκ τῶν Θέωνος συνουσιῶν, from which it was inferred that the compilation of the elements was the work of Theon, from the materials left by Euclid. It is certain that Theon, in his commentary on the Almagest, speaks of his edition (ἔκδοσις) of Euclid, and mentions that the part of the last proposition which relates to the sectors was added by himself. On looking at that proposition, it is found that the demonstration relative to the sectors comes after the 'ὅπερ ἔδει δεῖξαι,' with which Euclid usually ends his propositions. And Alexander, the commentator on Aristotle, who lived before Theon, calls that the *fourth* proposition of the tenth book which is the *fifth* in all the manuscripts. We can then distinctly trace the hand of Theon as a commentator, and may suspect that he performed the duty of a revising editor to the work of Euclid as it now appears; but there is not the smallest reason to suppose that Theon actually digested the work into the form which it now has. These remarks relative to the claims of Theon were first made by Sir Henry Savile, who opened the chair of geometry which he founded at Oxford by thirteen lectures on the fundamental parts of the first book of Euclid, which were delivered in 1620, and published in 1621.

We now give a short summary of the early editions of Euclid, which have appeared in Greek or Latin. It is unnecessary to specify the common editions of Simson, Playfair, &c., &c., which confine themselves to the first six books, and the eleventh and twelfth, and are generally known.

I. Editions of the whole of Euclid's works. (1.) An imperfect Latin edition, by Bartholomew Zamberti, Venice, 1505. (2.) A Latin edition, printed at Basle, marked 'Basileae apud Johannem Hervagium,' 1537, 1546, and 1558. (3.) Greek edition, with Scholia, Basle, 1539. But the principal edition of all the works of Euclid is that published by the Oxford press in 1703, under the care of David Gregory, then Savilian professor.

II. Greek editions of the Elements only. (1.) An edition curâ Simonis Grynæi, Basle, 1530. (2.) Another, with the commentary of Proclus, 'Basileæ apud Johannem Hervagium,' 1533. (3.) Greek and Italian, by Angeli Cajani, Rome, 1545. (4.) At Strasburg, 1559. (5.) Greek and Latin, with Scholia, by Conrad Dasypodius, Strasburg, 1564.

III. Latin editions of the 'Elements' only. (1) That of Campanus, the first Euclid printed, Ratdolt, Venice, 1482. (2.) A reprint of the preceding, marked 'Vincentiæ, anno salutis 1491.' (3.) An edition containing the text and comment of Campanus, from the Arabic; also the text and comment of Zamberti, from the Greek; Paris, Henry Stephens, 1505; and again in 1516. This edition is very commodious for a general comparison of the Greek and Arabic. (4.) Edition of Lucas de Burgo, Venice, 1509, according to Murhard, and 1489 according to Heilbronner, who appears to be the authority for the existence of this edition, and is doubted (with reason, we think) by Harles, in his Fabricius. (5.) Edition of Stephen Gracilis, Paris, 1557, 1573, 1578. The first edition of Clavius is that of Rome, 1574; of Commandine, Pesaro, 1572. [CLAVIUS; COMMANDINE.]

IV. Earliest editions of the Elements in modern tongues. *English*:—The Elements of Geometry of the most antient philosopher Euclid of Megara, &c., by H. Billingsley, with a preface by John Dee, London, 1570, and again in 1661. *French*:—Les quinze livres des Eléments, &c., &c., Par D. Henrion, Mathematicum, First edition, Paris, 1565? second, 1623, with various others. According to Fabricius, there was an edition by Peter Forcadel, in 1565. *German*:—Die sechs ersten bucher, &c., by William Holtzmann, Augsburg, 1562. Scheubelius had previously given the 7th, 8th, and 9th books, in 1555. *Italian*:—Euclide Megarense Philosophe, &c., per Nicolo Tartalea, Venice, 1543. *Dutch*:—De ses erste boecken Euclidis, &c., dor Jan Pieterszoon Dou, Amsterdam 1608 (or 1606). *Swedish*:—De sex forsta, &c., by Marten Stromer, Upsal, 1753. *Spanish*:—By Joseph Saragoza, Valentia, 1673. Murhard (compared with Fabricius) is the authority for all of these, except the first.

It has long ceased to be usual to read more of Euclid than the first six books and the eleventh. Those who wish to see more of the Elements will probably most easily obtain those of Williamson (London, 1788, two volumes 4to.), the translation of which is very literal. Those who prefer the Latin may find all the twelve books in the edition of Horsley (from Commandine and Gregory), Oxford, 1802. As to the Greek, the edition of Gregory is scarce, as is the edition of Peyrard, in Greek, Latin, and French, Paris, 1814; that of Camerer and Hauber, Berlin, 1824, contains the first six books in Greek and Latin, with valuable notes. The number of editors of Euclid is extremely great, but our limits will not allow of further recapitulation.

Under the names of Archimedes, Apollonius, Pappus, Proclus, Theon, &c., the reader will find further details upon the progress of Greek geometry, which continued to flourish at Alexandria till the taking of that town by the Saracens, A.D. 640. But its latter day produced only commentators upon the writers of the former, or, at most, original writers of no great note. In the following articles, LOCUS, PORISM, DUPLICATION, PROPORTIONAL, will be found some of the details of the Greek geometrical analysis. Their spherical trigonometry, or rather that portion of their geometry which supplied its place in astronomy, must be looked for under HIPPARCHUS, MENELAUS, THEODOSIUS, PTOLEMY. For some account of their arithmetical geometry, see NUMBERS, THEORY OF; IRRATIONAL QUANTITIES. The following list contains the names of the most celebrated geometers who lived before the decline of the Greek language: the dates represent nearly the middle of their lives, but are in many instances uncertain:—

Thales, B.C. 600; Ameristus? Pythagoras, 550; Anaxagoras; Œnopides; Hippocrates, 450; Theodorus; Archytas? preceptor of Plato; Leodamas; Theætetus; Aristæus, 350; Perseus? Plato, 310; Menæchmus, Dinostratus, Eudoxus, contemporaries of Plato; Neoclides; Leon; Amyclas; Theudius; Cyzicinus; Hermotimus; Philippus; Euclid, 285; Archimedes, 240; Apollonius, 240; Eratosthenes, 240; Nicomedes, 150; Hipparchus, 150; Hypsicles, 130? Geminus, 100; Theodosius, 100; Menelaus, A.D. 80; Ptolemy, 125; Pappus, 390; Serenus, 390; Diocles? Proclus, 440; Marinus? Isidorus? Eutocius, 540.

The age of Diophantus is not sufficiently well known even for so rough a summary as the preceding.

The following is the summary of books of geometrical analysis (qui ad resolutum locum pertinent), given by Pappus as extant in his time: of Euclid, the *Data*, three books of porisms, and two books *locorum ad superficiem*; of

Apollonius, two books *de proportionis sectione*, two *de spatii sectione*, two *de tactionibus*, two *de inclinationibus*, two *planorum locorum*, and eight on conic sections; of Aristæus, five books *locorum solidorum;* of Erastosthenes, two books on finding mean proportionals. But besides these he describes a book (of Apollonius) which treats *de determinatâ sectione*.

The manifold beauties of the Elements of Euclid secured their universal reception, and it was not long before geometers began to extend their results. It became frequent to attempt the restitution of a lost book by the description given of it by Pappus or others; and from Vieta to Robert Simson, a long list of names might be collected of those who have endeavoured to repair the losses of time. On the advance of geometry in general the reader may consult the lives of Vieta, Metius, Magini, Pitiscus, Snell, Napier, Guldinus, Cavalieri, Robeval, Fermat, Pascal, Descartes, Kepler, &c., &c., and also the article QUADRATURE OF THE CIRCLE.

The application of algebra to geometry, of which some instances had been given by Bombelli, and many more by Vieta, grew into a science in the hands of Descartes (1596-1650). It drew the attention of mathematicians completely away from the methods of the antient geometry, and considering the latter as a method of discovery, the change was very much for the better. But the close and grasping character of the antient reasoning did not accompany that of the new method: algebra was rather a half-understood art than a science, and all who valued strictness of demonstration adhered as close as possible to the antient geometry This was particularly the case in our own country, and unfortunately the usual attendants of rigor were mistaken for rigor itself, and *vice versâ*. The algebraical symbols and methods were by many reputed inaccurate, while the same processes, conducted on the same principles, in a geometrical form, were preferred and even advanced as more correct. Newton, an admirer of the Greek geometry, clothed his Principia in a dress which was meant to make it look (so far as mathematical methods were concerned) like the child of Archimedes, and not of Vieta or Descartes: but the end was not attained in reality, for though the reasoning is really unexceptionable, yet the method of exhaustions must be applied to most of the lemmas of the first section, before the Greek geometer would own them.

The methods of algebra, so far as expressions of the first and second degrees are concerned, apply with great facility to many large classes of questions connected with straight lines, circles, and other sections of the cone. Practical facility was gained by them, frequently at the expense of reasoning: the time came when a new Descartes showed how to return to geometrical construction with means superior to those of algebra, in many matters connected with practice. This was Monge, the inventor of *descriptive geometry*. The science of perspective and many other applications of geometry to the arts had previously required isolated methods of obtaining lines, angles, or areas, described under laws not readily admitting of the application of algebra, and its consequence, the construction of tables. The descriptive geometry is a systematized form of the method by which a ground-plan and an elevation are made to give the form and dimensions of a building. The projections of a point upon two planes at right angles to one another being given, the position of the point itself is given. From this it is possible, knowing the projections of any solid figure upon two such planes, to lay down on either of those planes a figure similar and equal to any plane section of the solid. In the case where the section is a curve it is constructed by laying down a large number of consecutive contiguous points. The methods by which such an object is to be attained were generalized and simplified by MONGE, whose *Géométrie Descriptive* (the second edition of which was published in 1820) is one of the most elegant and lucid elementary works in existence.

The methods of descriptive geometry recalled the attention of geometers to the properties of projections in general, of which such only had been particularly noticed as could be applied in the arts of design or in the investigation of primary properties of the conic sections. From the time of Monge to the present this subject has been cultivated with a vigour which has produced most remarkable results, and promises more. Pure geometry has made no advance since the time of the Greeks which gives greater help to its means of invention than that which the labours of what we must call the school of Monge have effected. On this point we shall refer to PROJECTIONS, THEORY OF. One of the most distinguished pupils of this great master, M. Chasles, has just published an 'Aperçu historique des méthodes en Géométrie,' forming the eleventh volume of the 'Mémoires Couronnés' of the Academy of Brussels. The very recent date of this work has prevented us from being able to say more than that it appears to be sufficiently learned in matters of antient geometry, and that it offers a most satisfactory view of the progress of all ages, in connexion with those generalized methods of which its object is to treat.

On the history of geometry, as distinguished from other parts of mathematics, there is very little to cite. The references in the article MATHEMATICS may be consulted.

GEOMETRY OF THE GREEKS. [GEOMETRY.]

GE'OMYS. [MURIDÆ.]

GEOPHO'NUS. [FORAMINIFERA, vol. x., p. 348.]

GEOPO'NIKA (or, a 'Treatise on Agriculture,') is the title of a compilation, in Greek, of precepts on rural economy, extracted from antient writers. The compiler, in his proemium, shows that he was living at Constantinople, and dedicated his work to the emperor Constantine, 'a successor of Constantine, the first Christian emperor,' stating that he wrote it in compliance with his desire, and praising him for his zeal for science and philosophy, and for his philanthropy. This emperor is supposed by some to have been Constantine Porphyrogenitus, and the compilation is generally ascribed to Cassianus Bassus, a native of Bithynia, who however is stated by others to have lived some centuries before the time of Porphyrogenitus. The question of the authorship of the 'Geoponika' has excited much discussion. Needham, in his Greek and Latin edition of the 'Geoponika,' Cambridge, 1704, has treated the subject at great length. The work is divided into twenty books, which are subdivided into short chapters, explaining the various processes of cultivation adapted to various soils and crops, and the rural labours suited to the different seasons of the year; with directions for the sowing of the various kinds of corn and pulse; for the training of the vine, and the art of wine-making, upon which the author is very diffuse. He also treats of olive plantations and oil-making, of orchards and fruit-trees, of evergreens, of kitchen-gardens, of the insects and reptiles that are injurious to plants, of the economy of the poultry-yard, of the horse, the ass, and the camel; of horned cattle, sheep, goats, pigs, &c., and the care they require; of the method of salting meat; and, lastly, of the various kinds of fishes. Every chapter is inscribed with the name of the author from whom it is taken, and the compiler gives at the beginning of the first book a list of his principal authorities, who are Africanus, Anatolius, Apuleius, Berytius, Damogeron, Democritus, Didymus, Dionysius Uticensis the translator of Mago the Carthaginian writer on agriculture, Diophanes, Florentinus, Leontius, Pamphilus, Paxamus, the Quintilii, Sotion, Varro, Vindanonius, and Zoroaster. Other authors besides these are quoted in the course of the work. Two or three chapters are inscribed with the name of Cassianus, who speaks of himself in them as a native of Maratonymus in Bithynia, where he had an estate. (*Geoponika*, book v., ch. 6 and 36.) The work is curious, as giving a course of antient agriculture collected from the best authorities then existing. The best edition of the 'Geoponika' is that of N. Niclas, in Greek and Latin, with notes and indexes, 4 vols. 8vo., Leipzig, 1781.

GEORGE (LOUIS) I., king of Great Britain. After the exclusion of James II. and his son in 1689, the nearest heirs to the throne in the lineal order of succession were—1. The Princess Mary of Orange, eldest daughter of James II.; 2. The Princess Anne of Denmark, younger daughter of James II.; 3. William prince of Orange, son of Mary, eldest daughter of Charles I. By the declaration of both houses of the convention on the 12th of February, 1689, it was resolved that after the decease of the prince and princess of Orange, the crown should descend, first, 'to the heirs of the body of the said princess; and for default of such issue, to the Princess Anne of Denmark, and the heirs of her body; and for default of such issue, to the heirs of the body of the said prince of Orange.' This settlement was confirmed in the second session of the first parliament of William and Mary, by the statute, 1 W. and M., s. 2, c. 2, commonly called the Bill of Rights. (Vol. iv. p. 404.) In the preceding session however, when

the Bill of Rights was first brought forward, the king had instructed his ministers to propose a clause for a further limitation of the succession, failing heirs of his own body, to the Electress Sophia of Hanover. The electress of Hanover (or, as appears to be the more correct electoral style, of Brunswick and Lüneburg), being the youngest of the ten children of Elizabeth, queen of Bohemia, the daughter of James I., stood in the regular order of inheritance, not only after the descendants of Henrietta, the younger daughter of Charles I., from whom sprung the royal houses of Savoy, France, and Spain, but also after the descendants of her own elder brothers, Charles Louis, Elector Palatine, the ancestor of the houses of Orleans and Lorraine, and Edward, through whom the houses of Salm, Ursel, Bourbon, Conty, Maine, Modena, and the Imperial family were brought into the line of succession. All these families however were Catholic; that of Hanover was the nearest Protestant family after the house of Orange. The proposition for the insertion of the name of the Princess Sophia in the bill respecting the settlement of the succession was made, according to the king's desire, in the House of Lords, and adopted there; but when the bill was sent down to the Commons, the clause was opposed both by the Tory and by the Republican parties, though on opposite principles, and was thrown out in spite of all the exertions of the Court. The consequence was, that after the bill had been under discussion for about two months, it was for the present allowed to drop altogether, on the birth (24th July) to the Princess Anne of a son, William, afterwards proposed to be created duke of Gloucester (he died before the patent passed the great seal), by which it seemed to be rendered of less pressing importance. When it was brought in again in the following session, the proposition respecting the Princess Sophia was not renewed; but by a clause excluding Papists, the succession, as King William himself expressed it in writing to her on the subject, was 'in a manner brought to her door.' The death of Queen Mary however (January 1, 1695), and that of the duke of Gloucester, the last of seventeen children that had been born to the princess of Denmark (30th July, 1700), made it extremely desirable that the matter of the succession should no longer remain unsettled. The subject accordingly was strongly recommended to the attention of parliament in the royal speech delivered February 10, 1701. The recommendation was coldly received by the majority of the House of Commons; but at length, by the contrivance, it is said, of the parties opposed to the scheme, the further limitation of the crown to the Electress Sophia and her heirs was formally proposed by Sir John Bowles, 'who,' says Tindal, 'was then disordered in his senses, and soon after quite lost them.' It is affirmed that a proposition was now made by several influential members of the Upper House to the ambassador of the duke of Savoy, that that prince should send one of his sons to be educated as a Protestant in England, in which case they gave their assurance that the plan of the Hanoverian succession should be defeated; but the duke would not consent. Meanwhile a bill, founded on the motion of Sir John Bowles, was introduced into the House of Commons; and although it remained in suspense for many weeks, it was eventually carried through both houses. This is the 12th and 13th Will. III., c. 2, which declares that the crown of England, France, and Ireland, 'after his majesty and the Princess Anne of Denmark, and in default of issue of the said Princess Anne and of his majesty respectively,' should descend 'to the most excellent Princess Sophia, electress and dutchess dowager of Hanover, and the heirs of her body, being Protestants.' The settlement thus made was further confirmed the next session by the 13th Will. III., c. 6, called the Abjuration Act, from the oath abjuring allegiance to the pretender therein enjoined to be taken and subscribed. The clause imposing this oath was carried in the House of Commons by only one vote; the Tories, by whom it was opposed, endeavouring to strengthen their cause by insinuations (which were most probably entirely without foundation) that the Court now meditated the bringing in of the Hanover family even before the Princess Anne. Several attempts were made after this to prevail upon the parliament of Scotland to adopt the same settlement for the crown of that kingdom which had thus been established for the English crown; but they were all ineffectual, till the object was at last accomplished in 1706 by the Treaty of Union, the second article of which declared 'that the succession to the monarchy of the United Kingdom of Great Britain, and of the dominions thereunto belonging, after her most sacred majesty, and in default of issue of her majesty, be, remain, and continue to the most excellent Princess Sophia, electress and duchess dowager of Hanover, and the heirs of her body, being Protestants, upon whom the crown of England is settled' by the act already mentioned. Before this, by the 4 Anne, c. 1 and 4, the Princess Sophia, 'and the issue of her body, and all persons lineally descending from her, born or hereafter to be born,' were naturalized, so long as they should not become Papists. By the 4 Anne, c. 8, also, the next Protestant successor to the throne was empowered to name any additional number of persons to act with seven lords-justices appointed in the statute to administer the government between the death of the queen and the arrival of the said successor in the kingdom. Most of these arrangements were confirmed by various clauses in the 6th Anne, c. 7, entitled 'An Act for the Security of Her Majesty's Person and Government, and of the Succession to the Crown of Great Britain in the Protestant Line.' Finally, by the 10th Anne, c. 4, passed in 1711, precedence was given to the Princess Sophia, to 'the most serene elector of Brunswick Lunenburgh, her son and heir-apparent, the most noble George Augustus, electoral prince of Hanover and duke of Cambridge, only son of the said most serene elector, and also the heirs of the body of the said most excellent princess, being Protestants, before the archbishop of Canterbury, and all great officers, and the dukes, and all other peers of these realms.' The Hanoverian succession was guaranteed by the treaty concluded with the United Provinces of Holland in 1706, by the Barrier Treaty between Great Britain and Holland in 1709, and by the Treaty of Guarantee between the same powers in 1713; and the validity of the settlement was acknowledged by the Treaties of Peace concluded in the last-mentioned year, at Utrecht, between Great Britain and France, and between Great Britain and Spain. (*General Collection of Treaties*, vol. i. p. 434; vol. ii., p. 479; and vol. iii., pp. 361, 398, and 470.)

After the accession of Anne, no party affected so great a zeal for the Hanoverian succession as the extreme section of the Tories, or Jacobites, whose object, of course, was anything rather than really to support the parliamentary settlement. In 1705, Lord Rochester, one of the heads of this faction, first intimated obscurely in the House of Lords, and more openly among his friends, his intention of proposing that the Electress Sophia should be invited to come over to reside in England. 'It was thought,' says Tindal, 'that they either knew or apprehended that this would not be acceptable to the queen; and they, being highly displeased with the measures she took, went into this design both to vex her and in hopes that a faction might arise out of it, which might breed a distraction in our councils, and some of them might hope thereby to revive the Pretender's claim.' The proposition was also, obviously enough, calculated to be very embarrasing to the Whigs, who if they assented to it would probably cut themselves off from all chance of the favour of the court, of which they were at this time in expectation, while by resisting it they would endanger both their popularity with the nation and also perhaps the confidence of the Hanoverian family. The next session a motion that the heiress presumptive to the throne should be invited over was formally made in the House of Lords by Lord Haversham, but after a warm debate (at which the queen was present), it was rejected by a great majority. Some years after, in altered circumstances, nearly the same game was attempted to be played by the Whigs, at whose instigation, in April, 1[illegible] the Hanoverian resident, Baron Schütz, suddenly made application to the Lord Chancellor Harcourt for a writ of summons to the House of Lords to the Electoral Prince (afterwards George II.), who had been made a British Peer in 1706, by the title of Duke of Cambridge. This application, and a report which was at the same time spread that the Duke of Cambridge would in any circumstances immediately come to England, threw the ministry into no small perplexity, and so greatly annoyed and irritated the queen that she forbade Baron Schütz to appear at court. The following year however another report was spread, that the Princess Sophia intended to solicit permission from her majesty for the Electoral Prince to come to England. On this the queen wrote both to the Princess, to her son the Elector, and to the Electoral Prince himself, expressing her disapprobation of the project in the strongest terms. The letters to the Princess and the Elector (dated St. James's,

19th May, 1714), have been published, but that to the Electoral Prince is said to have been in a style so unbecoming both the writer and the person addressed, that it could not be given to the world. These letters may be said to have killed the heiress presumptive; she was so much affected by them, that on the day after their receipt, the 28th of May, she was struck with apoplexy as she was walking in the gardens of Herenhausen, and expired in the arms of her daughter. The Princess Sophia, who was one of the most accomplished women of her time, was in her eighty-fourth year when her life was thus terminated. Queen Anne died on the 1st of August following, on which George, Elector of Brunswick, the son of the Electress Sophia, became king of Great Britain.

George I. was born 28th May, 1660 (the day before that on which Charles II. made his entry into London at the Restoration). In 1681 he came over to England with the intention of paying his addresses to the Princess (afterwards Queen) Anne; but immediately after landing he received his father's orders not to proceed in the business, on which he returned home, and in the following year married his cousin Sophia Dorothea, the daughter of the Duke of Zell. He afterwards served in the armies of the Empire both against the Turks and the French. He succeeded to the electorate on the death of his father in 1698. In 1700 he led a force to the assistance of the Duke of Holstein, who was attacked by Frederick IV. of Denmark, and, in conjunction with the Swedes under General Banier, compelled King Frederick to raise the siege of Tonningen. Hanover had been created a ninth electorate by the Emperor Leopold in 1692, but in consequence of the opposition of other electoral houses it was not till 1708 that the duke was admitted into the college of electors. Duke Ernest, the father of George I., had originally attached himself to the French interest, but his adhesion to England was of course secured by the settlement of the succession to the crown on his family, although it is probable that neither he nor even his son regarded that arrangement as very secure until the latter actually found himself seated on the throne. The Elector George remained steady to the English alliance throughout the general war which began in 1702, and both in 1707 and the two following years he commanded the Imperial forces against the French. All the endeavours of the English ministry however could not prevail upon him to go along with them in the original propositions for the peace of Utrecht. To all the arguments and solicitations addressed to him on that occasion, he answered that he desired to be spoken to simply as a German Prince, and that no consideration of any future connexion he might have with Great Britain should for the present induce him to depart from what he held to be the true interest of the Empire. In fact, he stood out till the conclusion of the treaty of peace between the French King and the Emperor, at Rastadt, 6th March, 1714.

The accession of George I. took place as quietly, and as much like a thing of course, as any such change has ever done in the most settled times. The new king, with the prince his son, arrived at Greenwich on the 28th of September, 1714. Before this the Tories, who had been in power at the death of Queen Anne, had all been dismissed by the Lords Justices; and now a new ministry was formed consisting, with the single exception of the earl of Nottingham (who was removed within a year), wholly of Whigs, Viscount Townshend and the celebrated Mr. (afterwards Sir Robert) Walpole being its most influential members. A new parliament, which gave ministers a great majority in the Commons, having assembled in January, 1715, immediately proceeded to the impeachment of Bolingbroke, Oxford, and their associates, all of whom were compelled for the present to bend to the storm. These determined (or, as some called them, vindictive) measures however probably did not do much to strengthen the position of the new dynasty. The rebellion in Scotland broke out before the end of the year, and was not completely put down till February, 1716. [Scotland.] One of the consequences by which it was followed was the repeal of the Triennial Act by the 1st Geo. I, stat. 2, c. 38, entitled '*An Act for enlarging the time of continuance of parliaments*,' by which it was declared that not only all future parliaments, but even the parliament then sitting, might be continued for seven years,—certainly the most daring assumption of power upon which an English parliament has ever ventured. The year 1717 was ushered in with the rumour of an intended invasion of the country by Charles XII. of Sweden, who had been irritated by the recent purchase by the king of England, from the Danes, of the two duchies of Bremen and Verden, which the latter had taken from Sweden in 1712. To counteract the designs of Sweden, to which the Czar Peter of Russia had been induced to become a party, George I. lost no time in arranging what was called the Treaty of Triple Alliance (concluded at the Hague 4th of January, 1717) with France and Holland. This war however was not marked by any operations of importance, and it was put an end to by the death of Charles XII. before the end of the following year. Meanwhile, in April, 1717, the ministry of Townshend and Walpole was broken up by the dismissal of the former and the immediate resignation of the latter—the result of internal dissensions which had been for some time growing, and of the intrigues of a section of the Whig party. The heads of the new cabinet were Mr. (afterwards Lord) Stanhope, who became first lord of the treasury and chancellor of the exchequer in the room of Walpole, and the earl of Sunderland, who took the office of one of the principal secretaries of state, Mr. Addison being taken in as the other. The intrigues of Cardinal Alberoni, which had also been at the bottom of the late demonstrations of hostility by Sweden, now led to a war with Spain. Here England was again cordially assisted by France, the Spanish minister's ambitious designs embracing at once the expulsion of the Hanoverian family from the government of the former, and of the Regent Duke of Orleans from that of the latter. The Quadruple Alliance between Great Britain, France, the Emperor, and Holland was now arranged, and various military operations took place, the most distinguished of which was the victory obtained by Admiral Sir George Byng (afterwards Lord Torrington) over the Spanish fleet off the coast of Sicily (31 July, 1718), in which about fifteen of the enemy's ships were captured or destroyed. In June, 1719, also, a Spanish force that had landed in Scotland, and had been joined by a body of Highlanders under the command of the Earl Marischal and Lord Seaforth, was defeated by General Wightman in an action fought at Glenshield, in Inverness-shire, and compelled to surrender at discretion—a check by which a second Jacobite rebellion was at once put down. The differences with Sweden however were finally accommodated by the treaty of Stockholm, signed the 20 November, 1719; and before the close of the same year Cardinal Alberoni was dismissed by the king of Spain, and peace was soon after made also with that power. A concurrence of events now brought about a change of ministry. In April, 1720, a reconcilement was effected between the king and the prince of Wales, with whom he had been for some years at variance; this re-introduced Walpole, who had attached himself to the prince, into the ministry in the subordinate capacity of paymaster of the forces, and soon after the terrible explosion of the South Sea scheme at once overthrew the administration of Stanhope and Sunderland by the extent to which several members of the cabinet were personally involved, and produced a crisis in which Walpole, with his great financial skill and reputation, found every thing thrown into his own hands. He became again first lord of the treasury and chancellor of the exchequer in April, 1721, commencing from that date a premiership which lasted for twenty-one years, being the longest period that any English minister has continued in power since the time of Lord Burleigh. Of the transactions in domestic politics under the late administration, the most remarkable were the repeal in 1718 of the Schism Act, passed in the last year of Queen Anne—a repeal which, to his discredit, Walpole, actuated by considerations of party, opposed to the utmost, though happily without success; and the attempt of the ministers in 1718 and 1719 to carry their celebrated bill for the limitation of the peerage, in which they were defeated by the junction of Walpole with the Tories.

The pacific dispositions of Walpole, and the continued friendship of France, both under the government of the duke of Orleans and afterwards under that of Cardinal Fleury, tended to preserve the repose of Europe during the latter years of the reign of George I.; but it was, on the other hand, constantly endangered both by the persevering intrigues of the adherents of the family that had been ejected from the British throne, and still more by the apprehensions of the king for the safety of his German dominions, and the entanglement of the country in continental politics through that connexion. The most memorable event of 1722 was the detection of the conspiracy for bring-

ing in the Pretender, in which the celebrated Atterbury, bishop of Rochester, was involved. War was at length rekindled by the alliance formed between the king of Spain and the emperor by the treaty of Vienna, signed the 30th of April, 1725, and the treaty of Hanover, concluded the third of September following, between England, France, and Prussia, to which Sweden afterwards acceded. The siege of Gibraltar was begun by Spain in February, 1726, and a British fleet was about the same time sent to the West Indies under command of Admiral Hosier, where in consequence of contradictory or indecisive orders it remained inactive till the admiral and nearly all his crew perished of disease—a calamity which at the time occasioned a vehement outcry against the administration. Preliminary articles for a general pacification however were signed at Paris, 31st May, 1727. On the 3rd June following, king George embarked at Greenwich for Hanover, but had only reached Osnaburg when he was struck with apoplexy, and died there in the night between the 10th and 11th June, in the sixty-eighth year of his age, and the thirteenth of his reign.

By his unfortunate queen, who died 2nd November, 1726, at the castle of Ahlen in Hanover, in which she had been immured since 1694, on a charge, never proved and generally disbelieved, of an intrigue with Count Koningsmark, George I. had one son, George, by whom he was succeeded, and a daughter, Sophia Dorothea, born 16th March, 1687, and married in 1706 to king Frederick II. of Prussia. George I. has the credit of not having allowed himself to be influenced in affairs of state by the female favourites with whose society he solaced himself. Of these one who enjoyed his chief favour after he came to the English throne was Erengard Melosine de Schulenberg, who in 1716 was created duchess of Munster, in the Irish peerage, and in 1719 duchess of Kendal, in the English peerage, for life, her niece Melesine de Schulenberg (afterwards married to Philip earl of Chesterfield) being also made countess of Walsingham for life in 1722. This woman, who survived till 1743, the king is believed to have married with the left hand. His other chief mistress in his latter days was Charlotte Sophia, wife of Baron Kilmansegg, countess of Platen in Germany, and created countess of Leinster in Ireland, 1721, and countess of Darlington in England, 1722, who died in 1730.

A fair share of the courage and obstinacy of his race, steadiness to his engagements and his friendships, and considerable sagacity in the management of affairs, were the marked qualities in the character of this king. He was to the end of his life however in all his views and notions, and in his conduct, much more elector of Hanover than king of England; and his excessive anxiety about not merely the safety but the extension of his hereditary dominions undoubtedly helped to involve this country in the net of continental politics to an extent not before known. Other circumstances of the time however also contributed to this result. George I. is said to have had little taste for literature, science, or the fine arts; but the country is indebted to him for the foundation (in 1724) of a professorship of modern history in each of the universities.

It is impossible within the limits to which we are confined to attempt even the most general account of the changes made in the law by the many hundred pages of legislation which were added to the Statute Book in the course of this reign. Among the most remarkable of the new laws may be mentioned the 1 Geo. I. st. 2, c. 5, commonly called the Riot Act; the 6 Geo. I. c. 5, which declared that the 'kingdom of Ireland hath been, is, and of right ought to be subordinate unto and dependent upon the Imperial crown of Great Britain; and that the British parliament had, hath, and of right ought to have, power and authority to make laws and statutes of sufficient force and validity to bind the kingdom and people of Ireland,' but which was repealed by † the 22 Geo. III. c. 53; the 9 Geo. I. c. 22, commonly called the Black Act (from the name of the 'Blacks' taken by one of the descriptions of depredators against which it is directed); and the 11 Geo. I. c. 26, entitled 'An Act for the more effectual disarming the Highlands in Scotland, and for the better securing the peace and quiet of that part of the kingdom.' The commencement of this reign also forms an important æra in the history of the national finances, from the establishment in 1716, under the government of Walpole, of the first sinking fund on a great scale, by the 3 Geo. I. c. 7. The national debt, which amounted to about 52,000,000*l.* at the commencement of this reign, underwent no reduction in the course of it; but the interest was reduced from about 3,350,000*l.* to 2,217,000*l.* The power of effecting this reduction was principally obtained through the effects of an act passed in the last year of the preceding reign (the 12 Anne, st. 2, c. 16), by which the legal interest of money was reduced from 6 to 5 per cent.

GEORGE (AUGUSTUS) II., king of Great Britain, the only son of George I. and his queen Sophia Dorothea, was born at Hanover, October 30, 1683. On the 22nd August, 1705, he married Wilhelmina Caroline, daughter of John Frederick, margrave of Brandenburg Anspach. On the 9th November, 1706, he was created a British peer by the title of duke of Cambridge; but he never received a writ of summons to the House of Lords, nor indeed did he visit England till his father succeeded to the throne. The project that was at one time entertained of bringing him over has been noticed in the preceding article. In the war with France he served with his father in the army of the allies, and particularly distinguished himself at the battle of Oudenarde, gained 11th July, 1708, by the duke of Marlborough over the French forces commanded by the duke of Burgundy. On the death of Queen Anne he accompanied his father to England, and was declared prince of Wales at the first privy-council held by George I. 22nd September, 1714. The heir-apparent was immediately seized upon as an instrument of political intrigue. In the debates on the civil list in May, 1715, one of the propositions of the tories was to settle an independant revenue of 100,000*l.* per annum on the prince of Wales, but the motion to that effect was negatived in the House of Commons by a great majority. The same sum however was allowed to the prince by the king out of the income of 700,000*l.* voted to his majesty by parliament. On the 5th May, 1715, the prince received the appointment of captain-general of the Artillery Company; and on the 6th July, 1716, he was constituted guardian of the realm and lieutenant of the king during the king's absence in Hanover. While thus left to administer the government, he was present on the 6th December at Drury Lane Theatre, when a lunatic, of the name of Freeman, a man of property in Surrey, suddenly rushed towards the box where he was, fired at the sentinel who endeavoured to stop him, and severely wounded him in the shoulder, and was not secured without great difficulty, when three other loaded pistols were found about his person. In the general confusion and alarm, the prince is said to have shown perfect presence of mind and self-possession. A quarrel between the king and the prince broke out on the 28th November, 1717, on occasion of the baptism of a son of which the princess of Wales had been delivered on the 3rd of that month; the immediate cause of the rupture was the displeasure expressed by the prince at the duke of Newcastle standing godfather with the king, instead of the king's brother, the duke of York, whom he wished to have been appointed. 'But it seems,' observes a contemporary writer (Salmon, in 'Chronological Historian'), 'there were other reasons of this misunderstanding, with which we are not to be acquainted.' The next day the king sent his commands to the prince to keep his own apartment till his pleasure should be further known: soon after he was desired to quit St. James's, on which his royal highness and the princess went to the house of the earl of Grantham, in Albemarle Street. The children however, by the king's order, remained at St. James's; and shortly after, the judges, being consulted, decided, by a majority of ten to two, that the care of the education of the royal family belonged of right to the king. (See an account of the proceedings in Hargrave's *State Trials*, xi., 295-302.) At this time the family of the prince of Wales consisted of a son, Frederick Lewis, born in 1707, and three princesses, Anne, born 1709, Amelia, born 1711, and Caroline, born 1713, besides the infant Prince George William, who died in the beginning of the following year. On the 24th December his majesty's pleasure was formally signified to all the peers and peeresses, and to all privy-councillors and their wives, that all persons who should go to see the prince and princess of Wales should forbear coming into his majesty's presence; such persons also as had employments both under the king and prince were obliged to quit the service of one of them. According to Tindal, the king also consulted the judges whether he could retain for the maintenance of the children some part of the 100,000*l.* granted by parliament to the prince. It does not appear

that any such grant was ever made by parliament; but by the 1 George I. st. 2, c. 22, it was enacted that his majesty's grant of 100,000*l*. per annum to the prince of Wales should be paid without fees and free from taxes; and that it might be specially charged on such branches of customs and excise as were applicable to the civil-list, which may have been considered as a parliamentary sanction of the grant. The judges, Tindal adds, were divided upon this point, but seemed rather to favour the prince; on which 'the prince and princess stood their ground; and though they left to the king the education of their children, they refused to contribute towards the expense.' The king formed a household for the young princesses, and on the 10th January, 1718, he created his grandson, Prince Frederick Lewis, duke of Gloucester.

The king paid another visit to Hanover in May, 1719. On this occasion 'the prince and princess of Wales,' says Tindal, 'not being appointed regents, retired into the country, and appeared no more till the king's departure, a few days after which they came to St. James's to see the young princesses, who kept a levee twice a week; and to them it was that the lords-justices and a numerous appearance of foreign ministers, nobility, and gentry, made their compliments on the king's birthday.' It is believed that the famous Peerage Bill of this year [GEORGE I.] was brought forward chiefly in consequence of the quarrel between the king and his son, and with the view of limiting the powers of the latter when he should come to the throne. In the final discussion which it underwent in the House of Commons in November, Sir John Packington observed that some persons had through indiscretion occasioned an unhappy difference in the royal family, and he was apprehensive if that bill, so prejudicial to the rights of the next heir, should pass into a law, it might render that difference irreconcilable. The allusion here was understood to be to the earl of Sunderland, then first lord of the treasury and prime minister, the mover and most zealous promoter of the bill.

The reconciliation of the king and the prince was at last effected in April, 1720, chiefly by the endeavours of the duke of Devonshire and Mr. Walpole, who had for some time past attached themselves to the court of his royal highness. On the 23rd of that month an interview took place between the father and son; and the termination of their difference was immediately announced to the public by the prince, on his return to Leicester-house, being attended by a party of the yeomen of the guard and of the horse-guards, and by the foot-guards beginning to mount guard at his house. The reconciliation however was probably never very cordial. It may be observed that when the king immediately after this set out to pay another visit to his continental dominions, he left the government in the hands of lords-justices, as on the last occasion. A story is told by Horace Walpole which appears to show that the king's animosity lasted to the end of his life. After having destroyed two wills which he had made in favour of his son, he had entrusted a third, supposed to have been of an opposite character, to the keeping of Wake, archbishop of Canterbury, who on the accession of George II. presented it to the new king. To the surprise of every one present, his majesty, putting it into his pocket, stalked out of the room, and the will was never heard of more. Lord John Russell, in relating this story (*Memoirs of Affairs of Europe*, ii. 396) observes that 'by the law of England the will would not have been valid; all property, real as well as personal, of the king, descends with the crown.' It does not appear to be now understood that this is law.

George II. succeeded his father, 10 June, 1727. It was at first his intention to place at the head of the government Sir Spencer Compton (afterwards earl of Wilmington), who was then the speaker of the House of Commons; but when that person received the royal commands to draw up the declaration to the privy-council, he was obliged to call in Walpole to assist him. Queen Caroline, whose influence with her husband was very great, now interposed; and the result was that Walpole was continued in office. The war with Spain was finally terminated by the treaty of Seville, concluded 9th November, 1729; and for ten years from this time Walpole contrived to preserve peace. New causes however of dissatisfaction with Spain arose, principally out of alleged interferences of that power with the freedom of English commerce; and the minister at last found it impossible to resist the cry of the country for a new war. Hostilities were commenced in the close of the year 1739; and the reduction of Portobello, on the isthmus of Darien, by Admiral Vernon, in the beginning of the following year, still further sharpened the eagerness with which the popular feeling had rushed into the contest. The operations that were subsequently attempted however were not equally successful; repeated attacks upon Carthagena, in particular, all signally failed. The death of the emperor Charles VI. in October, 1740, speedily produced a general European war; Great Britain supporting the settlement called the Pragmatic Sanction, by which the succession to the Austrian dominions devolved upon the late emperor's eldest daughter, Maria Theresa, queen of Hungary; France and Spain uniting to maintain the claims of Charles Albert, elector of Bavaria (elected emperor in 1742 under the title of Charles VII.). Meantime various causes had been co-operating to shake Walpole's power. The mere length of his tenure of office had tired the country and created impatience for a change. The pacific policy in which he had so obstinately persevered had disgusted the general eagerness for a war excited by a feeling that the national interest and honour alike demanded recourse to arms, and the course he had taken in this respect had impaired his reputation as much as his popularity. His scheme for the extension of the excise, introduced in 1733, had, although abandoned, produced an unfavourable impression that sunk deep into the popular mind, and an outcry against him that never subsided. The loss of his steady and influential protectress, Queen Caroline, who died 20th November, 1739, deprived him of one of his strongest supports in the favour both of the king and the nation. Just before that event also a violent quarrel had broken out between the king and the prince of Wales, who now headed the opposition, and collected around him at Leicester-house a court and party, one of the chief of whose avowed objects was the removal of the premier. In these circumstances a new parliament met 4th December, 1741, in which Walpole soon found himself so placed as to make it necessary to retire. He resigned all his places in the end of January, 1742, and was immediately created earl of Orford. So long as he lived however, which was not more than three years, Walpole continued really the king's chief adviser. The ministry that immediately succeeded was nominally appointed by his great rival Pulteney, but it was in reality the result of a compromise, and Pulteney himself was by Walpole's contrivance annihilated in the very moment of his apparent triumph, by being compelled to leave the House of Commons and to take a peerage: as earl of Bath he became at once nobody. A reconciliation at the same time took place between the king and the prince; but neither this nor any of the other arrangements lasted long. In a few months the prince was again in opposition, and the new ministry was assailed by an adverse force, composed in part of their antient allies, as formidable as that which had driven Walpole from power.

Meanwhile the war against the Bavarians and their allies the French had begun to be prosecuted with great vigour; the kings of Denmark and Sweden (the latter in his capacity of landgrave of Hesse Cassel) having been subsidized, and a treaty of alliance concluded with Frederick III. of Prussia, George II. joined his army on the Continent in person in the beginning of June, 1743, and on the 26th of that month shared in the great victory gained over the French at Dettingen. On this occasion the English king behaved with distinguished courage. This instance of success however was only followed by inactivity and reverses; one consequence of which was the expulsion from the ministry, in November, 1744, of Lord Granville (formerly Lord Carteret), the great promoter of the war, and as such the member of the cabinet who had the greatest influence with the king. The ministry that was now formed was called the Broad-Bottom ministry: it contained a few tories, but consisted principally of the Newcastle and Grenville whigs, the only parties wholly excluded being the connexions of lords Granville and Bath. Mr. Pelham, brother of the duke of Newcastle, was first lord of the treasury and chancellor of the exchequer, and Mr. Pitt (afterwards so distinguished both under that name and as earl of Chatham) being promised a place as soon as the king could be induced to admit him, gave his support in the meantime to the administration. This change of men however brought no change of measures. The king's German politics continued to receive the same support from the new ministry as they

had from the old. Nor was the war carried on with better fortune. The defeat of the allies at Fontenoy, 30th April, 1745, was the great event of the next campaign.

In August of the same year another Jacobite rebellion, instigated by France and Spain, broke out in Scotland; the towns of Dunkeld, Perth, Dundee, Edinburgh, and Carlisle, rapidly fell into the hands of the insurgents; the king's troops were routed at Preston-pans and Falkirk; and the Pretender, Charles Edward, had already advanced as far as Derby in his bold march upon the metropolis of the empire before any successful attempt was made to resist him. The rising however which had worn so threatening an aspect was completely put down by the victory of Culloden gained by the king's second son, the duke of Cumberland, 16th April, 1746. In the preceding February, in the very midst of the public alarm, the king had made a sudden attempt to reinstate lords Granville and Bath as the heads of the ministry; but after being three days in office they saw that the project was hopeless; on which Mr. Pelham, who had resigned, was taken back, and continued at the head of affairs till his death in 1754.

The treaty of Aix-la-Chapelle, the preliminary articles of which were signed 30th April, 1748, at last put an end to the war, the latter years of which were distinguished by some brilliant naval successes on the part of Great Britain. The conditions of this peace on the whole excited great dissatisfaction in England, especially the restoration of Cape Breton, which had been taken from the French in 1745, and had been accounted the great acquisition of the war. On the other hand Madras, which a French fleet had reduced in 1746, was recovered. The power of the ministry however was not shaken by the vigorous and persevering assaults upon the treaty by the opposition in parliament; and Mr. Pelham and his friends also triumphed in a division that broke out in the cabinet after the death of the prince of Wales (20th March, 1751), on the subject of the Regency Bill rendered necessary by that event, when the Pelhams, to whom Mr. Pitt attached himself, were opposed by the party of the dukes of Cumberland and Bedford, and their protegé Mr. Fox, the origin of a long and still unextinguished rivalry. But the death of Mr. Pelham, 6th March, 1754, produced a succession of new contentions, intrigues, and changes. At last, in November, 1755, Pitt and his friends were dismissed, and Fox, as secretary of state and manager of the House of Commons, became, under the duke of Newcastle, who since his brother's death had held his offices and nominal station, the moving spirit of the ministry.

Meanwhile however war had again broken out with France in the preceding June;—in one quarter of the world indeed, in India, the French and English, as allies of the conflicting native powers, can scarcely be said to have ever laid down their arms;—but the new quarrel of the two governments took its rise from a disagreement about the boundaries of their respective possessions in North America, which had been left unsettled by the late treaty. The war, in which all the principal European powers were eventually involved, is known by the name of the Seven Years' War. Its commencement was extremely disastrous to the English, Minorca and Calcutta having both fallen to the French in the summer of 1756. The popular indignation excited by these reverses overset the administration of the duke of Newcastle. Deserted by Mr. Fox, his grace resigned in the beginning of November; and by the end of December, Pitt, who had for some time past attached himself to the court of the young prince of Wales at Leicester-house, was secretary of state, with a cabinet composed of his own friends and those of Lord Bute. The antipathies of the king however, and the intrigues of the duke of Newcastle, overthrew this arrangement in a few months. In April, 1757, Earl Temple, who held the office of first lord of the Admiralty, having been dismissed, Mr. Pitt immediately gave in his resignation. It was some time before anybody could be induced to accept the task of constructing a new cabinet; at last, in the beginning of June, after the country had been for nearly two months without a government, the earl of Waldegrave was appointed first lord of the treasury, with Mr. Fox as secretary of state. This administration lasted only for a few days: the king was then informed that he must seek for other aid. After some further negotiation, Mr. Pitt was before the end of the month recalled and appointed premier, with the office of secretary of state, the duke of Newcastle being made first lord of the treasury, and Mr. Fox paymaster of the forces This arrangement subsisted to the end of the reign. From the moment in which the chief direction of affairs was thus placed in the hands of Mr. Pitt the war was prosecuted with extraordinary vigour and success. In January, 1756, a treaty of alliance had been contracted with Prussia, and an alliance between Austria and France was concluded in May of the same year. The commencement of active hostilities between Austria and Great Britain signalized Mr. Pitt's accession to power. In Germany the enemy were, early in 1758, driven out of Bremen and Verden, which they had overrun the preceding year; soon after, Senegal, Goree, and other possessions of the French on the coast of Africa, were reduced; in 1759 the great victory of Minden, gained (1st August) by Ferdinand, the hereditary prince of Brunswick, drove back the French to the Rhine; by a succession of brilliant successes at sea the French navy was almost annihilated; the victory on the Heights of Abraham, in which Wolfe fell (13th September), all but completed the conquest of Canada; Cape Breton, in the same quarter of the globe, had been already recovered; in the East, Clive had recovered Calcutta (2nd January, 1757), taken Chandernagore (14th March), overthrown the Subahdar of Bengal at the great battle of Plassy (23rd June), and was now engaged in driving the French from every remaining possession they had held in India. In the midst of these successes George II. expired suddenly at Kensington from the extraordinary circumstance of a rupture of the right ventricle of the heart, on the 25th of October, 1760, in the 77th year of his age, and 34th of his reign. His children by his queen, besides those that have been already mentioned, were: William Augustus, born 1721, created in 1726 duke of Cumberland; Mary, born 1723, married 1740 to Frederick, landgrave of Hesse Cassel; and Louisa, born 1724, married 1743 to Frederick V. king of Denmark. He was succeeded by his grandson, George III.

In his sentiments and politics George II. was as much a German as his father, and he persevered throughout his reign in the same system of interference in the affairs of the Continent, professedly with the object of maintaining the balance of power, but really with an especial view to the preservation of the hereditary possessions of his family. Though his Hanoverian partialities however occasioned considerable outcry when the wars in which the country was engaged were unfortunate, all this was forgotten in the splendid successes which at the close of his reign crowned the British arms both by sea and land, and at the moment of his death George II. perhaps enjoyed as much popularity as any prince that ever sat on the English throne. Both morally and intellectually his character seems to have very much resembled that of his father; he is said to have been somewhat passionate, but open, straightforward, and placable, though apt to entertain antipathies of considerable obstinacy, as well as steady in his attachment to those who had once attracted his regard. The only study to which he had any partiality was the art of war, in which he conceived himself to be a great adept. His queen Caroline was a woman of considerable strength of character as well as of cultivated mind, and as long as she lived she exercised great influence over her husband. There was a succession of royal mistresses however in this reign, as well as in the preceding. When George II. was Prince of Wales he fell or professed to fall violently in love with the reigning beauty of the day, Mary, daughter of John lord Bellenden, who was one of the Princess's maids of honour; she however rejected his proposals, and married Colonel Campbell, one of the grooms of his bedchamber, who many years after became duke of Argyle. On this the prince attached himself to Mrs. Howard, who succeeded to her place in the household of his wife, and she long continued to hold notoriously the situation of the king's first female favourite, though her influence, it is said, was never equal to that of the queen. Another of this king's mistresses was Amelia Sophia de Walmoden, who in 1740 was created countess of Yarmouth for life—the last instance of this scandalous abuse of the royal prerogative, and prostitution of the honours of the state.

Of the mass of legislation added to the Statute-book during this reign no very large portion retains any importance at the present day. Among the measures most deserving of notice may be mentioned, the Act 4 Geo. II., c. 26, ordering that all proceedings in courts of justice in England, and in the Court of Exchequer in Scotland,

should be in the English language (two years afterwards extended to Wales); the 8 George II., c. 6, establishing a Registry of Conveyances, Wills, &c., in the North Riding of York; the 8 Geo. II., c. 13, which established a copyright in engravings; the 9 George II., c. 5, repealing the old statutes against witchcraft; the 10 George II., c. 28, prohibiting the acting of any new stage play without permission of the lord chamberlain (this was occasioned by some theatrical ridicule directed against Walpole); the 18 Geo. II., c. 15, separating the surgeons of London from the barbers; the 19 George II., c. 39, entitled an Act for the more effectual disarming the Highlands in Scotland, and for restraining the use of the Highland dress, &c.; the 20 George II., c. 30, allowing persons impeached of high treason to make their full defence by counsel; the 20 George II., c. 43, abolishing heritable jurisdictions in Scotland; the 20 George II., c. 50, taking away the tenure of Wardholding in Scotland, and converting it into Blanch and Feu Holdings [FEUDAL SYSTEM]; the 24 George II., c. 23, establishing the use of the New Style; the 26 George II., c. 2, for purchasing the Museum of Sir Hans Sloane and the Harleian MSS., the foundation of the British Museum; the 26 Geo. II., c. 26, being an act permitting Jews to be naturalized by parliament without taking the sacrament, which however was repealed the following year; and the 26 George II., c. 33, commonly called the Marriage Act.

The national debt was considerably more than doubled in the course of this reign; its amount at the conclusion of the Seven Years' War, in 1763, was nearly 139,000,000*l.*, paying an interest of above 4,850,000*l.* The annual parliamentary grants, which at the beginning of the reign usually amounted to about three millions, or three millions and a half, rose at its close to twelve, fifteen, and at last to nineteen m llions.

The country nevertheless undoubtedly made great progress in wealth and general improvement during the reign of George II. Commerce and manufactures were greatly extended; both the useful arts and those that embellish life found a demand and encouragement that was constantly increasing; and various branches both of literature and science were cultivated with considerable ardour and success. We may refer to the conclusion of Smollett's History for an elaborate and comprehensive survey of what was done in all these departments; some of the names which he enumerates as likely to distinguish the age are now little remembered, but many more, including Sanderson, Bradley, Maclaurin, the two Simpsons, and Hales, in science, and Sherlock, Hoadley, Secker, Warburton, Leland, Thomson, Akenside, Armstrong, Home, Gray, Johnson, the two Wartons, Robertson, Hume, Fielding, and Smollett himself, in literature (not to mention Swift, Pope, and Young, the survivors of a former age), are not likely to be forgotten. To these may be added Mead, Pringle, Hunter, Munro, Cheselden, and Sharp, in medicine and surgery; Arne, Boyce, and Handel (who however was a foreigner), in music; and Ramsay, Reynolds, and Hogarth, in painting.

GEORGE (WILLIAM FREDERICK) III., the eldest son of Frederick Lewis, prince of Wales, was born 4th June, 1738. His mother was Augusta, daughter of Frederick II., duke of Saxe Gotha, born 1719, married to the prince of Wales 25th April, 1736. Their other children were—1, Augusta, born 1737, married 1764 to Charles William Ferdinand, duke of Brunswick Wolfenbüttel, died 1813; 3, Edward Augustus, born 1739, created duke of York 1760, died 1767; 4, Elizabeth Caroline, born 1741, died 1759; 5, William Henry, born 1743, created duke of Gloucester 1764, died 1805; 6, Henry Frederick, born 1745, created duke of Cumberland 1766, died 1790; 7, Louisa Anne, born 1749, died 1768; 8, Frederick William, born 1750, died 1765; 9, Caroline Matilda, born 1751 (four months after her father's death), married to Christian VII., king of Denmark, 1766, died 1774.

On the death of his father, 20th March, 1751, prince George succeeded to the title of duke of Gloucester, but he was created prince of Wales on the 20th of April. His mother, under whose care he remained, soon disengaged herself from, or was deserted by, the leaders of the parliamentary opposition which had gathered around and made a tool of her husband; but the king's habitual dislike to her appears never to have been overcome. It has been asserted that, encouraged by the manner in which the princess was treated by the rest of the royal family, the prince's governor, lord Harcourt, and his preceptor, Dr. Hayter, bishop of Norwich, exerted their influence to prejudice him both against the old friends of his father and against his mother herself. Another account is that the princess was prejudiced against the governor and the preceptor by lord Bute, who now became her confidential adviser. [BUTE, EARL OF.] From whatever cause, lord Harcourt and the bishop resigned their places in December, 1752; the ground which they assigned was that Mr. Stone, the prince's subgovernor (placed in that situation by the ministry), Mr. Scott, another tutor (who had been recommended to the late prince by lord Bolingbroke), and Mr. Cresset (who had been appointed treasurer of the prince's household on the recommendation of his mother), were all concealed Jacobites. Stone, it was affirmed, had about twenty years before actually drank the Pretender's health in public. This charge, in which Dr. Johnson, bishop of Gloucester, and Mr. Murray, afterwards the celebrated lord Mansfield, were also involved, was made the subject not only of an inquisition by the cabinet, but afterwards of a debate in the house of lords. It appears to have rested on little or no good evidence. Ample details of the affair, which excited some inflammation in the public mind at the time, are given in Dodington's 'Diary.' Lord Waldegrave was soon after appointed the prince's governor, and Dr. John Thomas, bishop of Peterborough (afterwards of Salisbury, finally of Winchester), his preceptor; and under their management and the more influential superintendence of lord Bute, matters proceeded without further dissension. The prince was kept by his mother in great privacy, and permitted to associate only with a very small and select circle. Her royal highness seems to have been actuated by good intentions; she was very anxious to preserve her son from the contamination of the fashionable profligacy of the day; and in this respect her method may be allowed to have been successful. But in regard to any thing beyond this, both her own notions and those of the persons in whose hands she placed herself were narrow in the extreme. One of her complaints to Dodington against the bishop of Norwich was that he insisted upon teaching the prince and his brothers logic, 'which, as she was told, was a very odd study for children of their age, not to say of their condition.' Bute indeed appears to have felt the propriety of some political instruction being given to the heir-apparent; but his lordship, although he soon after adventured upon the office of prime-minister, had himself scarcely any practical acquaintance with political matters, and had never even made that department of knowledge his study. Independently therefore of his party prejudices, which gave him a general bias towards what would now be called by most people antiquated and illiberal opinions, he was from mere ignorance of the subject a very unfit director of the political studies of the prince; nor were any of his coadjutors or subordinates much more competent. Their pupil accordingly cannot be said to have ever to the end of his life mastered more than the details and conventional forms of political science. In 1759, when he had attained his majority, the prince took his seat in the house of peers; but there is no record of his having taken any part in the business of the house.

George III. succeeded to the throne on the death of his grandfather, 25th October, 1760. Of his eventful reign of nearly sixty years we can here attempt only a very rapid sketch. On the 8th of July, 1761, the young king surprised his council by the unexpected announcement of his intention to marry the princess Charlotte Sophia, second daughter of Charles Lewis Frederick, duke of Mecklenburg Strelitz. The marriage took place on the 8th of September following. It is understood that in determining upon this union the king had the merit of sacrificing a private attachment to what were deemed considerations of political expediency. Throughout his reign indeed he never showed himself deficient in the strength of character necessary to make every thing else bend to what he held to be the demands of his public position. The youth and unblemished moral character of George III., and the circumstance of his having been born in the country, excited much popular regard and expectation on his accession to the throne. From the first however he did not conceal his anxiety for an end of the war which was then urged with so much national enthusiasm. Lord Bute, who had immediately on the commencement of the reign been admitted into the privy council, and made groom of the stole, was in a few months brought into the ministry, with the design probably of effecting that object. He was made secretary

of state in March, 1761. In the beginning of the following October Mr. Pitt resigned, on finding himself opposed by a majority of the cabinet when he proposed to anticipate the designs of Spain by declaring war against that power. The war with Spain, which he had predicted as inevitable, broke out in January, 1762: but in the beginning of June Bute became premier on the resignation of the duke of Newcastle; and on the 3rd of November the preliminaries of peace between France and England were signed at Fontainebleau. By the treaty of Paris, concluded 10th February, 1763, between Great Britain, France, Spain, and Portugal, this country retained possession of Canada, acquired Florida by cession from Spain, and recovered Minorca, but gave up Belleisle, the Havannah, and all the settlements taken from France in the East Indies. An attempt was made by the opposition to excite dissatisfaction with this treaty, but it was not very successful. Bute however resigned on the 8th of April, not so much, it would appear, in consequence either of any opposition in parliament or any unpopularity out of doors, as from want of support in the cabinet. He was succeeded by Mr. George Grenville, who was for some time however generally looked upon as merely the lieutenant of the retired minister. Mr. Grenville's administration commenced ominously with the famous contest with Wilkes, arising out of the publication of the 45th number of his 'North Briton,' on the 19th of April. This business, and the question of general warrants which was involved in it, occupied much of the early part of the following session of parliament. The close of the same session in April, 1764, was made memorable by the passing of the first resolutions asserting the expediency of imposing certain stamp-duties upon the colonies in America. A bill actually imposing such duties was brought forward the next session, and received the royal assent 22nd March, 1765.

In the meantime however various circumstances had concurred to shake the ministry. In the preceding April the king had been attacked by an illness generally supposed to have been the same mental malady with which he was afterwards visited oftener than once in a more serious form. On his recovery, which took place in a few weeks, he proposed that a bill should be brought into parliament empowering him to appoint the queen or any other member of the royal family to act, in case of his demise, as regent during the minority of his successor. The real author of this proposition was, no doubt, Lord Bute. The ministers had of late attempted to throw off his lordship, but on this occasion they did not venture openly to oppose the king's wish; they only attempted, when the bill was on its way through parliament, to exclude from it the name of the princess dowager of Wales. In this however they were signally defeated; a motion having been made in the Commons that the name of the princess should be inserted, the influence of the court and of Lord Bute were sufficient to carry it against ministers by the large majority of 167 to 37. The rising discontents in America came soon after, still further to embarrass Mr. Grenville and his colleagues. It was not however till after a great deal of negotiation that the king found himself strong enough to give them their dismissal.

At last, on the 10th July, 1765, a new ministry was formed, with the marquis of Rockingham at its head. This ministry, though not without considerable hesitation, repealed the American Stamp Act; the bill to that effect received the royal assent 20th March, 1766, and for the present this measure effectually allayed the disturbances in the colonies. The Rockingham ministry however soon came to an end, partly from inadequate support in parliament, partly from the lukewarmness of the court, chiefly from internal dissensions, if not treachery in some of its members. Soon after the prorogation of parliament in the beginning of June, Mr. Pitt was sent for by the king; and by the beginning of August that gentleman, transferred to the House of Lords with the title of earl of Chatham, was at the head of a new cabinet. It was during this administration that on 2nd June, 1767, Mr. C. Townshend, the chancellor of the exchequer, brought forward that renewed measure of American taxation which eventually led to the independence of the colonies. This is believed to have been Mr. Townshend's own scheme, Lord Chatham, though still the nominal head of the cabinet, being now in such a state of health, and so much at variance with the majority of his colleagues, that it is said he was never even consulted in the matter. Mr. Townshend died suddenly, 4th September, on which Lord North was appointed chancellor of the exchequer, and the ministry from this time came to be generally known as that of the duke of Grafton, who held the office of first lord of the treasury. Lord Chatham at last resigned, 15th October, 1768. With the meeting of parliament in the preceding June commenced the second and much more protracted struggle of the government with Wilkes, occasioned by his return for Middlesex, his expulsion by the House, and his repeated re-election. Meanwhile, the new plan of colonial taxation had thrown all English America into commotion as soon as it was announced. The beginning of the next year, 1769, was distinguished by the appearance of the first of the celebrated 'Letters of Junius,' the most effective series of political attacks ever directed against a ministry. The duke of Grafton, the object of the most envenomed shafts of this invisible assailant, suddenly resigned, 28th January, 1770. On this Lord North became premier, and began his administration with a bill, brought in 5th March, for the repeal of all the lately imposed American duties, except the duty on tea, which was retained avowedly merely to assert the right of taxation. This exception however produced the war with the colonies, and their eventual separation. A dispute with Spain about the possession of the Falkland Islands occupied attention for a short time in the latter part of this year, but was eventually adjusted without leading to hostilities. The session of parliament which terminated 8th May, 1771, is memorable for the successful assertion by the newspaper press of the right of reporting the debates, after a contest with the House of Commons, which lasted from the beginning of February to the end of April, and for two months of that time almost wholly occupied the House. This and the following year were also marked by some important events in the royal family. In the summer of 1771, the king's third brother, the duke of Cumberland, married Mrs. Horton, daughter of Lord Irnham (afterwards earl of Carhampton), and widow of Christopher Horton, esq. His Majesty, as soon as the affair was publicly announced, forbade the duke and duchess to appear at court; but this did not deter his second brother, the duke of Gloucester, from avowing, a month or two afterwards, his marriage with the countess dowager of Waldegrave (daughter of Sir Edward Walpole), which had taken place six years before. The Royal Marriage Bill was in consequence brought into the House of Lords, and, notwithstanding a strenuous opposition, passed into a law. By this statute (12 Geo. III. c. 11) all descendants of George II. (except the issue of princesses married into foreign families) are prohibited, while under the age of twenty-five, from contracting marriage without the consent of the king, and without the consent of parliament if above that age. The king's mother, the princess dowager of Wales, died on the 8th February, 1772. Only a few days before had occurred at Copenhagen the catastrophe of the king's youngest sister, the queen of Denmark, who was suddenly thrown into confinement by order of her imbecile and dissolute husband, on a charge of adultery with his physician Struensee. No proof of the criminality of the parties ever was produced, though both Struensee and his friend Brandt were put to death without trial. The queen was sent in the first instance to the castle of Cronsburg; but after being confined there for about four months, the interposition of her brother procured her release, and she was conveyed first to Stade, and afterwards to Zell, in Hanover, where she lived in retirement till her death, 10th May, 1774.

The disturbances in America, excited by the tea duty, broke out in the summer of 1773. The Gaspee schooner was attacked and burned at Providence in Rhode Island, in June: the destruction of the tea by the mob at Boston took place in December. Another year however was spent before the quarrel assumed the character of a regular contest of arms. Hostilities commenced with the battle of Lexington, 19th April, 1775; that of Bunker's Hill followed, 16th June. Still the resistance of the colonists had not taken the form of an avowed determination to throw off the dominion of the mother-country. It was not till the ever memorable 4th of July, 1776, that the contest was brought to this point by the Declaration of Independence. In the course of the next year many French officers joined the Americans, and it became evident that the governments both of France and of Spain were about to take part publicly with the revolted colonies. Meanwhile, on the 16th of October, the conven,

tion of Saratoga, and the surrender of Burgoyne, inflicted the first great blow upon the British cause. On the 6th February, 1778, a treaty was signed between the Americans and France, in which the independence of the former was acknowledged. War between England and France of course immediately followed this act. In June, 1779, Spain too at last openly joined the hostile confederacy; and before the end of another year England had found still another enemy in Holland. The convention of the northern powers of Russia, Denmark, and Sweden, (soon after joined by Holland, Prussia, and the Emperor,) for the maintenance of what was called the armed neutrality—being in fact a defiance of the power of Great Britain to enforce the commonly recognised rights of belligerents—was also established in the course of the year 1780. At home this was the year of the Protestant riots, when London was for nearly a week in the hands of a devastating mob, which was not put down till after a great effusion of blood, as well as destruction of property. The popular mind in Ireland moreover was in a state which occasioned the greatest alarm; the inhabitants were embodied as volunteers to the number of fifty or sixty thousand, and the British parliament had already in the beginning of this year been compelled to yield to some, and was soon to be forced to concede more, of the demands of these petitioners with arms in their hands.

Meanwhile the nation was becoming heartily tired of the war; and the ministry, surrounded by so many embarrassments, stood at the lowest point of unpopularity. These feelings continued to increase in the public mind, as new failures and calamities further demonstrated the incapacity or the ill luck with which the affairs of the country were conducted. Even in the East, where the French had at the commencement of the war been again driven from all their settlements, the successes of Hyder Ali now seemed to be fast changing the face of affairs. In America the surrender of Lord Cornwallis at Yorktown, on the 19th October, 1781, in effect terminated the struggle. Lord North and his colleagues resigned on the 20th March, 1782, on which the marquis of Rockingham was once more placed at the head of a new ministry; but his death about three months after his acceptance of office again overthrew all the arrangements that had been made. Lord Shelburne having succeeded to the place of first lord of the treasury and premier, Mr. Fox and all his friends immediately resigned. Among the new appointments was that of Mr. Pitt to the office of chancellor of the exchequer, in the room of Lord George Cavendish. It is said to have been by the persuasions of Lord Shelburne that the king was at last, after extreme reluctance, prevailed upon to consent to acknowledge the independence of the colonies. The preliminaries of a peace were signed at Paris on the basis of that acknowledgement on the 30th November; and on the 3rd September, 1783, the war, which had resulted in so large a curtailment of the dominions of the British crown, was formally brought to a close by the signature of definitive treaties with America, France, and Spain. Peace with Holland was also concluded at Paris, 20th June, 1784.

In the mean time however the famous coalition between the followers of Mr. Fox and of Lord North, parties which had been so long and so bitterly opposed, had succeeded in the beginning of April, 1783, in driving Lord Shelburne and his friends from power. Lord North and Mr. Fox now became secretaries of state together, with the duke of Portland as first lord of the treasury and nominal premier. This arrangement however was soon overthrown. The new cabinet was exposed from the first to a storm of public outcry, and this greatly aided the determined efforts of the crown to shake itself free from a ministry that had been forced upon it. The only strength of the coalition indeed lay in the existing House of Commons The defeat of Mr. Fox's India Bill in the House of Lords by the private exertion of the influence of the crown, 17th December, on the question of going into committee, was followed the next day by the dismissal of both Fox and North, and the immediate appointment of a new ministry with Mr. Pitt at its head. The contest of parties which ensued is the most memorable in the annals of parliament. It was only terminated by the dissolution of the parliament 24th March, 1784, and the overwhelming majority of supporters which the result of the elections gave to the court and the ministry in the new House of Commons. Throughout this long and violent struggle, Mr. Pitt's own firmness and resolution were seconded by the steady support of the king, who is said to have openly declared his determination, rather than receive back Mr. Fox as minister, to resign his crown and retire to Hanover.

The formidable front presented by the Irish volunteers in the season of the national difficulties and disorders had extorted from the British parliament, in 1782 and 1783, the repeal of the restrictive statute of 1720 [George I.], and the acknowledgment (by the 23 Geo. III., c. 28) of the complete independence of the parliament of Ireland. Both in Ireland and in England the agitation of the question of parliamentary reform occupied public attention for some time after the conclusion of the war; but it was productive of no results. On the 2nd of August, 1786, an attempt was made upon the king's life by a mad woman named Margaret Nicolson, who struck at him with a knife as he was alighting from his carriage at St. James's, but missed her aim. In November, 1788, his majesty was visited with a second and more serious attack of illness, which was admitted to be delirium, and from which he did not recover till the following March. On this occasion Mr. Fox and his friends contended that the powers of the government devolved as of right upon the Prince of Wales; but parliament stood by Mr. Pitt in his opposition to that doctrine, and a bill conferring the regency upon the prince with certain restrictions had nearly passed both houses when the king recovered. The parliament of Ireland in the mean time had made use of their lately acquired independence to offer the prince the government of that kingdom, without any restrictions. As the prince had attached himself to the party of which Mr. Fox was the head, expectations of important political changes were excited by the prospect of his royal highness becoming the head of the state.

The quiet which had for some years reigned in Europe was broken in 1789, by what soon became the all-absorbing subject of interest, the Revolution in France. The history of the remainder of the reign is chiefly that of the share borne by England in the wars which grew out of that great convulsion. Whatever may have been the inclination of the court, there can be no doubt that Mr. Pitt was reluctantly drawn into the war with France. The demand however that the country should take up arms was loudly made by the large section of the whig body, which, with Mr. Burke for its soul, went over to the ministry in 1792 and 1793; and this was also decidedly the general voice of the country. In point of fact, war was at last declared, not by England but by France, 1st February, 1793, a few days after the execution of the French king.

The general course of the war, almost from its commencement to its close, has already been sketched in the article Bonaparte. We shall here merely enumerate in their chronological order the principal events more immediately belonging to English history. Conventions were immediately made for carrying on operations against France with Naples, Sardinia, Prussia, the Emperor, Hesse-Cassel, Baden, Hesse-Darmstadt, Brunswick, and by George III. with himself in his capacity of Elector of Hanover. A treaty of mutual alliance with Holland already subsisted. Spain and Portugal also immediately became parties to the war. Finally Russia still professed to adhere to the combination against France, though the real object of the Empress Catherine was merely the partition of Poland, which she soon after effected in association with Austria and Prussia. The first military measure of the British government was to send a force to Holland under the command of the duke of York. In the campaign of 1793 the French were expelled from Flanders by the Austrians; and the allied army under the prince of Saxe-Coburg and the duke of York took Valenciennes and Condé. The duke however was afterwards repulsed with great loss in an attempt upon Dunkirk. Toulon was taken possession of by Lord Hood, but speedily recovered by the French. In 1794 the French fleet was signally defeated by Lord Howe in the Channel on the 1st of June; the English also became masters of Corsica. In 1795 the islands of Martinique, St. Lucia, and Guadaloupe in the West Indies, were taken from the French; Guadaloupe however was soon after retaken. The people of Holland now drove out the stadtholder, and with the assistance of the French established what was called the Batavian Republic; on this the Cape of Good Hope, Ceylon, and other Dutch possessions in the East Indies were seized by England. Peace was made with France by Prussia, 5th April, and by Spain, 22nd of July. In 1796 the English were compelled to withdraw

from Corsica; on the 5th of October Spain declared war against England; in the latter part of the same month an ineffective attempt was made to open negotiations for peace by the mission of Lord Malmesbury to Paris; in December an attempt of the French to make a descent upon Ireland was defeated by a storm which dispersed the invading fleet, having a force of 15,000 men on board, only two ships reaching the neighbourhood of Bantry Bay, which they left in a few days. The military events in which the British arms were concerned in 1797 were, the defeat of the Spanish fleet off Cape St. Vincent by Sir John Jervis, 14th February; the capture from the Spaniards of Trinidad, Porto Rico, and Teneriffe; and the great victory obtained by Lord Duncan over the Dutch fleet off Camperdown, 11th October. Peace with France having been made by Austria in April, another attempt at negotiation was made by the English government in the course of the following summer, Lord Malmesbury having been sent to meet the French plenipotentiaries at Lisle; but it ended in nothing. This was also the year of the suspension of cash-payments by the Bank of England, 27th of February—and of the mutiny in the fleet at Spithead in April, and at the Nore in June. The great domestic event of 1798 was the rebellion in Ireland, organized by the society of United Irishmen, which broke out in the end of May, and was not finally suppressed till the end of September. A small French force landed at Killala on the 22nd of August, and penetrated a considerable way into Connaught, but surrendered after a sharp contest to a detachment of the army of Lord Cornwallis, on the 11th of September. On the 1st of August this year Nelson gained his great victory of the Nile. In 1799 a new confederacy having been formed against France, to which Austria, Russia, Naples, and Turkey were parties, an English army was sent to the Netherlands under the command of the Duke of York, but it was soon compelled to evacuate the country. On the 4th of May, Tippoo Saib, the Sultan of Mysore, who had entered into alliance with the French, was defeated and killed, and his capital of Seringapatam taken by Sir David Baird, on which the greater part of his dominions was added to the English territory. In August Surinam was taken from the Dutch, whose ships of war also in the course of this year almost all fell into the hands of the English. Minorca and Malta were taken by the English in the course of the year 1800.

Notwithstanding these and other partial successes however, the heavy pecuniary exactions of the war, together with its evident failure in so far as respected an advance towards the attainment of any intelligible ultimate object, and the steady progress of the French arms in the subjugation of the Continent, had now wearied and worn out the enthusiasm even of the greater number of those who had been originally its most ardent supporters. By a considerable part of the nation the contest had come to be regarded with feelings of the bitterest aversion. The inflamed temper of the populace, excited in part by the notion which very generally possessed them, that the real object of the war in which the country was engaged was the repression of democracy and liberty both at home and abroad, had, among other excesses, led to an attack upon the king by the mob as he passed through the park in going to and returning from the House of Lords at the opening of the session of parliament on the 29th October, 1795. The feelings however which vented themselves in this manner were never participated in by any considerable portion of the community; the sentiment of the great majority of all classes of the nation was certainly, throughout the reign, one of kindness and respect towards his majesty, with which, in most cases, even strong political dissent from the general course of his government did not much interfere. The affection that was entertained for the king personally was remarkably shown by the numerous addresses of congratulation that were presented from all parts of the kingdom on his escape from the attempt of a maniac named Hatfield, by whom he was fired at with a pistol from the pit of Drury Lane Theatre, on the 15th May, 1800. In the spring of 1801 his majesty had another slight attack of his mental malady.

The important measure of the union of Great Britain and Ireland was after many difficulties at last effected in 1800. This event led, in March, 1801, to the resignation of Mr. Pitt, who now considered himself pledged to the removal of the Catholic disabilities, to which however the king firmly refused his assent. A new ministry was in consequence constructed, with the Rt. Hon. Henry Addington (afterwards Lord Sidmouth) at its head. Immediately before these events a rupture had taken place with Russia, and that power had united with Sweden and Denmark in the establishment of a new armed neutrality. The death of the Emperor Paul however soon led to a reconciliation between England and the three northern kingdoms. Meanwhile, on the 2nd April, Copenhagen was bombarded, and the Danish fleet partly taken, partly destroyed, by Nelson. In the East also, this year, the victory of Alexandria was gained over the French, with the loss of the gallant Sir Ralph Abercromby, on the 21st March; and on the 2nd September, Alexandria surrendered to Lord Hutchinson, and the French were compelled to evacuate Egypt. In the beginning of October it was unexpectedly announced that negotiations which had been for some time in progress had terminated in the signature of the preliminaries of a general peace. This news was received with universal satisfaction and rejoicing. The definitive treaty of peace was signed at Amiens, 25th March, 1802.

Within a year however hostilities were renewed. The course of the war from this period must be fresh in the recollection of many of our readers; we need only notice as its most remarkable occurrences, in so far as this country was concerned, the occupation of Hanover by the French, in 1803; the declaration of war by Spain, in December, 1804; the threatened invasion by France, and Nelson's glorious victory of Trafalgar, in 1805; the unsuccessful attempts to negotiate a peace, the capture of the Cape of Good Hope by England, and Bonaparte's Berlin Decree [BLOCKADE] of 1806; the seizure of the Danish fleet and the capture and subsequent evacuation of Buenos Ayres, in 1807; the insurrection in Spain, the alliance entered into with that country, and the expulsion of the French from Portugal, in 1808; the long contest begun in that year, which eventually achieved the liberation of the peninsula; the war with America, in 1812; the treaty with Russia, in that year; the treaties with Sweden and Austria, and the expulsion of the French from Hanover, in 1813; the peace with Denmark, in January, 1814; the surrender of Paris to the allies, in March; the abdication of Bonaparte and restoration of the Bourbons; the peace with America, signed at Ghent, in December; the return of Bonaparte from Elba, in March, 1815; and finally, the victory of Waterloo, in June following, which put an end to the war.

Of the public events which occurred within the kingdom during this period the most remarkable were:—the return of the king's illness for a few weeks in February, 1804; the restoration of Mr. Pitt to power, in May of that year; the death of Mr. Pitt, 23rd January, 1806; the accession of the ministry of Mr. Fox and Lord Grenville; the death of Mr. Fox, 13th September; the dissolution of the Grenville administration, in March, 1807, in consequence of the king refusing his assent to their proposed measures for the relief of the Roman Catholics; the formation of a new cabinet under the duke of Portland and Mr. Percival; the resignation of the command of the army by the duke of York, in March, 1809, in consequence of the result of an investigation on charges of corrupt practices (of which however it appeared that the profits were reaped, not by the duke, but by his mistress, the notorious Mrs. Clarke); the celebration, on the 25th October, that year, of the Jubilee, on the occurrence of the fiftieth anniversary of his majesty's accession; the commencement of the final insanity of the king, in the end of October, 1810; the consequent appointment, by act of parliament, of the prince of Wales as regent, in February, 1811; the assassination of Mr. Percival, 11th May, 1812; and the appointment of the earl of Liverpool as premier. The ministry of Lord Liverpool lasted during the remainder of the reign. The king continued in the same state of mental incapacity into which he had fallen, till his death at Windsor Castle on the night of Saturday, the 29th January, 1820, in the eighty-second year of his age and the sixtieth of his reign. He had been entirely blind for some years before his death.

For an enumeration of the children of George III. and Queen Charlotte (who died at Kew, 17th November, 1818) we refer to any of the Almanacs or Peerages. They were fifteen in all, namely, nine sons (of whom two, George, his successor, and William, have already reigned, and three are still living), and six daughters, four of whom are living.

On the subject of the character, moral and intellectual, of

George III. there is probably now not much difference of opinion. He had no pretensions to any superior penetration or vigour of understanding, but he possessed rather more than the ordinary endowment of practical tact and skill in the management both of affairs and of men. He was perfectly master of all the proprieties of his station, which never, at least on important occasions, lost any of its respectability or authority during his occupation of it. His firmness or tenacity of purpose was such as usually to defeat in the end any attempt that was made to thwart his wishes in the movements of domestic politics, and indeed it was generally believed that the royal spirit of determination or obstinacy had a considerable share in prolonging more than one of the great public contests in which the country was involved during this reign, after all reasonable hope of success had vanished. But it has generally been admitted that the persistency of George III., however mistaken or unfortunate, was for the most part conscientious—in other words, that he firmly believed himself to be in the right even in those cases in which he was possibly most in the wrong. The credit that was given to him upon this point operated with a powerfully favourable effect not only upon the estimation in which he was personally held, but in obtaining support to the measures of his government. The decorum of his private conduct also was of much service to him, as well as probably efficacious in no slight degree in giving a higher tone to the public manners and in making the domestic virtues fashionable even in the circles where they are most apt to be treated with neglect. It ought not moreover to be omitted, that, with whatever narrowness of view consequent upon his training and his position George III. may be chargeable, he was—what many influential persons of his time were not—an avowed friend to the diffusion of education, and certainly was not afraid that his subjects would be made either more difficult to govern or worse in any other respect, by all classes and every individual of them being taught to read and to write.

It is scarcely necessary to observe that over all our Western world, and nowhere more than in England, the period forming the reign of George III. is perhaps to be placed above every other of the same length in modern history for the multitude and vastness both of the social changes and of the accessions to almost every department of human knowledge by which it has been signalized. It is worth remarking however that even the political confusion and universal wars of the latter half of the period did not prevent that space from being at least as productive of valuable inventions and discoveries, and as distinguished for the busy and successful cultivation of every branch of science and literature, as the quieter time that preceded.

Very great changes took place in the extent of the British dominions during the reign of George III. Ireland ceased to be a separate kingdom—Hanover was lost and recovered—Canada was added to our colonies—our other and much more important possessions on the North American continent were severed from us—a new empire, immense in its extent and population, was acquired in India. On the whole, notwithstanding the loss of the American colonies, the power and influence of the state were undoubtedly much greater at the close of the reign than they were at its commencement. Of the commerce and wealth of the country it would be more correct to say that they were multiplied during this period than simply that they were increased. No financial operations were ever effected or undertaken or dreamt of in any other time or country approaching to the gigantic magnitude of those accomplished by the British government in the closing years of the late war. The revenue raised by taxation at the beginning of the reign was under nine millions; it did not reach ten millions till the year 1773; in 1780 it had increased to somewhat above twelve millions; in 1786 it was fifteen millions; in 1793, at the commencement of the war with France, it was seventeen millions. After this new taxes were imposed to a considerable amount, so that the entire revenue raised in 1800 exceeded thirty-four millions.* From this date it continued to rise every year, till, in 1815, it amounted to the immense sum of 72,210,512*l.* In the seven years from 1810 to 1816 inclusive, about 472,000,000*l.* were raised by taxes alone, being on an average above 67,000,000*l.* per annum. In 1819, the last year of the reign, the sum thus raised was still nearly 53,000,000*l.* The sums raised by loans were, to the end of the Seven Years' War in 1763, about 32 millions; during the American war (1775-1784) above 121,000,000*l.*; and during the last war with France (1793-1815) above 609,000,000*l.* In the year 1813, the total amount borrowed was 52 millions funded, and above 55½ unfunded, making, with the produce of the taxes, the total payments into the Exchequer for that year 107,597,660*l.*, being at the enormous rate of above two millions weekly. The national debt, which at the commencement of the reign was about 108,000,000*l.*, on which was paid an annual interest of not quite 4,000,000*l.*, had increased by the end of the reign to above 800,000,000*l.* of principal, bearing an interest of more than 30,000,000*l.*

The collection of the Statutes passed in the reign of George III. is nearly four times as large as that of the whole mass of preceding English legislation from the Conquest. We can only here mention, as having most of a popular or historical interest,—the Act of 1761, continuing the commissions of the judges notwithstanding any demise of the crown—the Royal Marriage Act already noticed—the Grenville act of 1770 (amended in 1788) for the settlement of disputed elections of members of the House of Commons—the act of 1782, disqualifying revenue officers from voting at elections, and government contractors from sitting in the house—the act of 1792 (commonly called Fox's Libel Law), declaring the right of juries to judge of the law as well as of the fact in cases of libel—the act of 1801, excluding clergymen from the House of Commons—the act of 1807, abolishing the Slave Trade—Sir Samuel Romilly's acts of 1811 and 1818, for the amelioration of the criminal law—the act of 1813, abolishing the penalties and incapacities to which Unitarians were formerly subjected—the act of 1819, abolishing the appeal of battle in cases of murder—the foreign enlistment act, of the same year—and the acts of that year, for the suppression of blasphemy and sedition, commonly called the Six Acts.

GEORGE (AUGUSTUS FREDERICK) IV., king of Great Britain, the eldest son of George III., was born 12th August 1762, exactly 48 years (making allowance for the difference of style) after the accession of the House of Hanover. On the 17th he was created by letters patent prince of Wales and earl of Chester, and was baptized the next day. He was made a knight of the garter, 26th December, 1765, and a few months afterwards was appointed by a king's letter, addressed to the lord mayor, captain-general of the Honourable Artillery Company of the city of London. The prince of Wales was educated along with his next brother Prince Frederick, bishop of Osnaburg (afterwards duke of York) in great privacy, and on a system of strict discipline.

In April, 1771, Lord Holdernesse was appointed governor; Mr. Smelt, sub-governor; Dr. Markham, bishop of Chester (afterwards archbishop of York), preceptor, and Mr. (afterwards Dr.) Cyril Jackson, sub-preceptor to the two princes. In 1776 however all these persons suddenly resigned their offices, for some cause which has never been satisfactorily explained. The common account is, that they found some political works which they considered objectionable put into the hands of the boys by the directions of the king. Their successors were, for the first few days, Lord Bruce (immediately afterwards created earl of Aylesbury), and then the Duke of Montague, as governor; lieutenant-colonel Hotham as sub-governor; Dr. Hurd, bishop of Lichfield and Coventry (afterwards of Worcester), as preceptor; and the Rev. William Arnold, as sub-preceptor. The prince, notwithstanding murmurs and remonstrances, of which notice began to be taken in the public prints, was kept by his father in a state of unmitigated pupilage till he was nearly eighteen, his seclusion being divided between Buckingham House, Kew, and Windsor. It was not till the year 1780 that the princes began to appear much in public. From this time the life of the prince of Wales for many years belongs for the most part to the *Chronique Scandaleuse* but among the various persons of both sexes with whom he was connected, there are a few names that may be said to have already become historic, and that cannot altogether be passed over. The first of his many con-

* We take this last sum and those that follow from the 'Official Tables' of the Board of Trade, part iii., p. 1. But the diversity of statement among the several authorities on these subjects is very great. According to Sir John Sinclair ('History of the Public Revenue,' 3rd edit. ii., 132, 133) the produce of the old and new taxes for 1800 was only a little above 26 millions. Colquhoun ('Wealth, &c. of the British Empire,' p. 198) makes the amount between 29 and 30 millions. These two statements will nearly agree with each other, and also with that of Macpherson ('Annals of Commerce,' iv., 508, 509), if we suppose the revenue of Ireland to be excluded from the first and included in the second.

nexions of a similar nature that became notorious was with Mrs. Mary Robinson, then an actress and the wife of an attorney. This lady (whose maiden name was Darby, whose early years were superintended by Mrs. Hannah More, who in the latter part of her life became the mistress of Colonel Tarleton, and died at Englefield Green, at the age of forty-two, in 1800, after having made herself well known by her novels and verses, as well as by her adventures) has told her own story in her own way in her 'Memoirs,' published after her death by her daughter. She was four years older than the prince, and already of damaged reputation, when she first caught his attention, in 1780, while acting Perdita in the 'Winter's Tale;' her influence lasted for not quite two years

In December, 1780, on the departure of the bishop of Osnaburg for Germany, where he remained for seven years, a separate establishment on a small scale was formed for the prince; and having now become legally his own master, he was from this time much in the public eye. It was now that he entered upon his intimacy with Charles Fox, Sheridan, and other leaders of the whig party, who happened accidentally to be also among the most distinguished patrons of the fashionable gaiety and licence of the day; one of the persons also with whom he formed the closest friendship about this time was the afterwards notorious duke of Orleans, then styled the Duc de Chartres, who paid long visits to London in 1783, and several following years. With these associates the prince indulged without restraint his propensities for gambling, horseracing, and other kinds of extravagance and dissipation. He also adopted warmly and openly the politics of his whig companions, and this at once placed him in direct opposition to his father's government. In April, 1783, however, his friends, under the name of the Coalition Ministry, forced themselves into power, and on the opening of parliament, on the 11th of November following, the prince of Wales was introduced with great ceremony into the House of Lords as Duke of Cornwall, and took his place among the supporters of the new administration. They had, immediately after entering upon their places, laid before the king the claims of the prince for an augmented establishment and allowance. The ministers demanded 100,000*l.* a year, but the king would not consent to more than 50,000*l.*, with an allowance of 60,000*l.* as an outfit: the prince had besides about 14,000*l.* a year as Duke of Cornwall. At the same time Carlton House was assigned to him as a residence. He stood by his friends on their expulsion a few months afterwards, notwithstanding some endeavours, it is said, on the part of his father to detach him, and took an active part in the private movements that were entered into without success for their reinstatement. In 1786 the subject of the prince's pecuniary embarrassments, which had become extremely pressing, was first mentioned in the House of Commons by his friend Sheridan, and this led to a negotiation with the king, who however, after keeping expectation in suspense for some time, finally refused to sanction any measures of relief. In these circumstances the prince resolved to break up his establishment, and to limit his expenditure to 5000*l.* a year, reserving the rest of his income for the payment of his debts. It was a short time before this that he had formed the most celebrated and lasting of his female attachments. Mrs. Fitzherbert, whose maiden name was Smith, was the daughter of a Catholic gentleman of Shropshire, and had been married first to Mr. Weld of Lulworth Castle, and secondly to Colonel Fitzherbert, who also died within a year after their marriage. She was still young and beautiful when the prince first saw her, in 1781; he immediately declared his passion, on which she went to the Continent, it is said, to avoid his importunities; but she returned in 1784, and soon after their connexion became generally known. All the circumstances of this affair have never been distinctly made public; but it would appear that Mrs. Fitzherbert considered herself as united to the Prince by marriage, and that this assumption was generally recognised by society, in which she certainly retained her place till her death, only a few years ago; even the subsequent marriage of the prince with another person not being held, it seems, to affect her pretensions, any more than the royal marriage act, according to which his marriage with her, in whatever circumstances it took place, could not have been legal. But the point which occasioned the greatest public outcry was the fact of Mrs. Fitzherbert being a Catholic, and, as such, a person by marrying whom the prince by the Act of Settlement would have become incapacitated to inherit the crown. The state of the prince's pecuniary affairs was again brought before parliament in April, 1787, by Alderman Newnham, one of the members for London; and on this occasion Mr. Fox came down to the house, and, on the express authority of the prince, characterized the supposed marriage with Mrs. Fitzherbert as a thing which not only had not happened, but which was even impossible to have happened. To a farther question he answered, 'That he denied the calumny as false *in toto*, in every sense of fact as well as law:' he added that he spoke from direct authority. There can be no question that Mr. Fox had been made to believe that not even any ceremony of marriage had ever been performed. It is said that Mrs. Fitzherbert, upon learning what had taken place, insisted, as the condition on which she would consent again to see the prince, that Mr. Fox's declaration should be as publicly and authoritatively retracted as it had been made: but it was found, after some attempts, that this could not be managed; and the lady soon afterwards yielded the point. She would never however speak to Mr. Fox again, who also complained strongly of the equivocating manner in which the prince expressed himself on the subject. The intimacy between the prince and Mrs. Fitzherbert continued without interruption till the summer of 1794; it was then suddenly broken off, but was a few years afterwards renewed.

The further parliamentary agitation of the prince's pecuniary difficulties in 1787 was prevented by the king at last giving his consent to a grant of 160,000*l.* for the payment of his son's debts, and of 20,000*l.* for completing the repairs of Carlton House. Both these sums were greatly inadequate, but the arrangement afforded some relief for the moment, and enabled the prince to resume his former state and habits of life. The king's illness, in the close of the year 1788, and the proceedings that took place in regard to the proposed regency, have been noticed in the preceding article. Upon this occasion Mr. Fox asserted that the 'exercise of the royal power was the clear right of the heir apparent, being of full age and capacity, during the king's incapacity;' but he afterwards admitted that 'the heir apparent had no right to *assume* the executive power,' and that, although the right was in the prince,' it was subject to the adjudication to him of its possession and exercise by the two houses.' It may be doubted how far his position was strengthened or made more intelligible by this qualification. On the king's recovery, both he and the queen chose to show themselves deeply offended with the conduct of the prince during his father's illness—although no distinct charge of undutifulness appears ever to have been alleged. A reconciliation however was effected about the beginning of the year 1790, through the interposition, it is understood, of Lord Thurlow, who had his own ends to serve. The king however would not consent to relieve the prince from his fast increasing embarrassments by another application to parliament, except upon the one condition, that he would marry.

It was in the summer of 1791 that a transaction occurred which made a great noise at the time and long afterwards,—the retirement of the prince from the turf, in consequence of the decision of the Jockey Club, that he must either take that step or dismiss a servant whom they held to be guilty of unfair management in relation to a particular race with one of his master's horses. The character of the tribunal is such as not to entitle us to draw from this decision any conclusion unfavourable either to the prince or his servant; the former had only a few hundred guineas depending on the race; and the circumstances seem to make it altogether improbable that either was guilty of the foul play imputed. The prince stood by his servant and settled on him an annuity of 200*l.* a-year. He soon after sold off all his horses, to the number of 500, and again retrenching his expenses and shutting up Carlton House, devoted the greater part of his income to the payment of his creditors. He now also publicly separated himself from Mr. Fox and his party by a speech in the House of Lords, the first he had ever delivered, 31st May, 1792, in which he declared his adherence to that section of his party which had gone over to the minister, in the division which had taken place on the subject of the French Revolution. He afterwards took a formal leave of his old friends in a letter addressed to the Duke of Portland.

At length in the summer of 1794, the prince, borne down by the heavy and rapidly augmenting load of his incum

brances, yielded to the demand so long urged by his father, and consented to marry. His unfortunate marriage with his cousin, Caroline Amelia Elizabeth, second daughter of the Duke of Brunswick and the princess Augusta, [GEORGE III.], took place on the 8th of April, 1795. On this his income was raised to 115,000*l.* a-year, 25,000*l.* being deducted from that sum for the payment of his debts, which according to the statement made to parliament amounted to about 650,000*l.* Disgust and alienation, as is well known, soon followed between the newly-married parties. So early as the beginning of June, the princess demanded the removal of Lady Jersey, who was one of her ladies in waiting; this the prince positively refused: the birth of a daughter, the late Princess Charlotte Augusta, on the 7th of January, 1796, produced no return of affection; they continued to live for some months longer under the same roof, but without speaking to each other; a complete separation then took place, the princess retiring with her infant, first to the village of Charlton, near Greenwich, and afterwards to Blackheath.

There are no events requiring much notice in the prince's history for some years after this. He frequently solicited his father to give him a military appointment, and a short time before the breaking out of the rebellion of 1798 he requested, it is said, to be allowed to undertake the chief government of Ireland; but all these petitions met with a determined refusal. About this time also he partially renewed his connection with Mr. Fox and his old friends—but it was now more an association of conviviality than of politics. The prince came nevertheless to be popularly considered as again the head or rallying-post of the whig party; and on that and other accounts the estrangement between him and his father soon became as complete as before. His conduct to the Princess of Wales was viewed by the king with the deepest displeasure. In these circumstances it naturally happened that the tories at this time clung to the princess, as their opponents did to her husband. Such was the political situation of the parties when the first investigation into the conduct of the princess took place in the latter part of the year 1806, by a commission constituted by royal warrant, and consisting of the late Lords Erskine, Grenville, Spencer, and Ellenborough, all then members of the cabinet. The allegations which led to this investigation proceeded from Sir John and Lady Douglas, who charged her royal highness not only with great impropriety and indecency of behaviour, but with having been delivered in 1802 of a male child, whom she had ever since brought up and retained near her under the name of William Austin. The report of the commissioners decidedly acquitted her royal highness on the latter and main charge; but added that there were other particulars deposed to by the witnesses examined respecting her conduct, 'such as must, especially considering her exalted rank and station, necessarily give occasion to very unfavourable interpretations.' The report however, and the answer of the princess (drawn up by her confidential advisers, Lord Eldon, Mr. Perceval, and Sir Thomas Plumer), together with other papers, having been afterwards submitted to the cabinet council (the whigs were now out of office), it was declared by a minute dated 22nd April, 1807, to be the unanimous opinion of the members not only that the two main charges of pregnancy and delivery were completely disproved, but 'that all other particulars of conduct brought in accusation against her royal highness, to which the character of criminality can be ascribed, are satisfactorily contradicted, or rest upon evidence undeserving of credit.' With the exception of these decisions, all the proceedings in this affair were kept secret for some years; but the depositions of the witnesses and the other papers were at length surreptitiously published in 1813, in the well-known volume entitled 'The Book.' The history of the investigation into the conduct of the princess is in all its stages curiously illustrative of the movements and changes of position of the two great political parties; she was condemned or acquitted by the official reporters upon her conduct, according as the party to which her husband attached himself or their opponents happened to be in power, and her cause was taken up by either as the prince bestowed his favour upon the other.

On the king being taken ill in the end of 1810 the prince of Wales was in the first instance appointed regent, with restricted powers, and for only one year. He entered upon his office by being sworn in before the privy council, 3rd February, 1811. The restrictions however were removed in the beginning of the following year. On thus becoming king in every thing but in name, the prince disappointed the expectations of a great part of the public by retaining Mr. Perceval and the other ministers whom he had found in office on assuming the direction of the government. In fact no change in the policy of the government was produced by the regency; the prince threw off at once both his former associates and their principles. It is unnecessary to recount, except very cursorily, the events of a period so recent that every reader must be supposed to possess a more complete knowledge of its history than we can here attempt to supply. The course of public occurrences down to 1820 has been shortly noticed in the preceding article. In the beginning of 1813, the unhappy differences between the prince and his wife again became the subject of parliamentary and public discussion, in consequence of the publication by the latter in the newspapers of a letter which she had addressed to the prince, remonstrating against some steps that had been taken in relation to the princess Charlotte. Upon that occasion the privy council, on the matter being submitted to them by the prince, reported that under all the circumstances of the case it was highly fit and proper 'that the intercourse between her royal highness the princess of Wales and her royal highness the princess Charlotte should continue to be subject to regulation and restraint.' Her former friends, the tories, had now completely abandoned the cause of the princess of Wales; the second name attached to this report was that of her recent confidential adviser Lord Eldon. The publication of 'The Book' immediately followed. In 1814 the visit of the emperor of Russia and king of Prussia to London, after the peace of Paris, led to renewed exposure and agitation, by the regent refusing to meet the princess at the drawing-room held by the queen for the reception of the foreign sovereigns. In resentment for her exclusion on this occasion, her royal highness left the country in the beginning of August, having first asked and obtained permission to make a tour on the Continent. It was understood that the intention now was to marry the Princess Charlotte to the prince of Orange, eldest son of the king of the Netherlands; but on the 2nd May, 1816, she was married to Prince Leopold George Frederick of Saxe-Coburg, the present king of Belgium. Her melancholy death in childbed followed on the 6th of November, 1817, an event which placed the duke of York next in succession to the crown. On the 5th of January, in this last-mentioned year, when the Prince Regent went to open parliament, he was shot at on his return through the Park; two balls perforated the glass of the carriage. This occurrence and the excited state of the country led to the suspension of the Habeas Corpus Act, and to various other measures curtailing the public liberties. At this time, of seven sons of the king no one had any issue; in these circumstances, in order to provide for the continuance of the line of succession, the dukes of Clarence, of Kent, and of Cambridge were all married in the course of the year 1818. The duke of Cumberland had been married in 1815, but his son, the present crown-prince of Hanover, and now, after his father, the nearest heir to the throne, was not born till 1819.

The Prince Regent ascended the throne as George IV. on the death of his father, 29th January, 1820. The first great public event of the new reign was the detection, on the 23rd February, of the Cato-street plot to assassinate the ministers. Queen Caroline arrived in London on the 6th June, and on the evening of the same day a message from the king was delivered to both houses of parliament, communicating papers respecting her alleged misconduct while abroad. On the 5th July, a bill for divorcing and degrading her was introduced into the House of Lords by the premier, Lord Liverpool; the examination of witnesses in support and refutation of the charges on which this measure professed to be founded occupied some succeeding months. On the 6th November, the second reading of the bill was carried by a majority of 123 to 95; on the 10th the third reading was only carried by 108 to 99; on this division, which destroyed all chance of the measure passing the Commons, it was abandoned. The queen however did not long survive her escape. The coronation of the king took place 19th July, 1821, when her majesty, having previously claimed it as her legal right to be crowned at the same time as queen consort, was repulsed in an attempt to obtain admission at the doors both of Westminster Hall and the Abbey. A few days after she was taken ill, and

died at Brandenburgh House, Hammersmith, 7th August. The king was at this time absent on a visit to Ireland; in the end of September he set out for Hanover, from which he did not return till the beginning of November; and in August following he went to Scotland. The suicide of the marquis of Londonderry, secretary for foreign affairs, occurred while the king was absent on this last visit, and produced some change in the foreign policy of the administration. [CANNING, GEORGE.] The year 1822 was marked by severe agricultural distress and much discontent in England, and by more serious disturbances in Ireland.

Of the foreign transactions of the two or three following years, the most important were the recognition of the new states of South America, by sending consuls to them in October, 1823; the contest with the Ashantees, in 1824 [ASHANTEES]; and the commencement in April that year of the Burmese war, which terminated in February, 1826, in the treaty of Yandaboo, giving the British a considerable accession of territory on the eastern coast of the Bay of Bengal. Of domestic events during the same period, the most memorable is the great commercial crisis of December, 1825. In December, 1826, a body of troops was sent to Portugal to support the princess regent and the constitution established by Don Pedro against the hostile attempts of the Spanish government and of the absolutist faction organized by that power; the British force speedily put down the rebellion and restored tranquillity. The death of the duke of York, 22nd January, 1827, transferred the character of heir presumptive to the duke of Clarence; and the office of commander-in-chief, in which the duke of York had been replaced soon after the commencement of the regency, to the duke of Wellington. The termination of the political life of Lord Liverpool by a stroke of apoplexy followed on the 17th of February; the consequence of which was a complete change of ministry. In the beginning of April Mr. Canning was appointed first lord of the treasury, and soon after chancellor of the exchequer, on which the great body of the whigs became the supporters of the new administration, while it was opposed by the duke of Wellington, Lord Eldon, Mr. Peel, and others of the premier's former friends and colleagues. [CANNING, GEORGE.] The death of Mr. Canning however, on the 8th of August, made a new arrangement necessary. Viscount Goderich (now earl of Ripon) then became premier, the duke of Wellington being reappointed to the command of the forces, with a seat in the cabinet. Some time after this arrangement had been completed, the news arrived of the destruction of the Turkish fleet in the Bay of Navarino in Greece, by the attack of the combined squadrons of England, France, and Russia; an occurrence which in his Majesty's speech, delivered at the opening of parliament, 29th January, 1828, was characterized as 'a collision wholly unexpected,' and an 'untoward event.' Meanwhile differences, of which various explanations were afterwards given, but which may be suspected to have had some relation to the affairs of Greece and Turkey, as well as to other matters both of foreign and domestic policy, had led to the resignation of Lord Goderich, and the appointment, on the 25th of January, of the duke of Wellington as first lord of the treasury. The new ministry however was still composed in part of the friends of the late Mr. Canning, as well as of the members of the tory party. This state of things lasted till the end of May, when a sudden misunderstanding or difference of opinion produced the resignation of Mr. Huskisson, which was immediately followed by that of Lord Dudley, Lord Palmerston, and Mr. Charles Grant. The ministry now came once more to be composed wholly of persons generally considered as belonging to the extreme, which was at the same time the main, division of the tory party. In particular, every member of the cabinet had hitherto been resolutely and steadily opposed to the concession of what was called the emancipation of the Catholics, and indeed to every other proposed mitigation, whether in substance or even in form, of the rigid Protestantism of the state institutions. The most important among the other events of this year were, the return, 5th July, of Mr. O'Connell, although a Catholic, as representative to the House of Commons for the county of Clare; the convention concluded 6th August, between Ali Pacha, viceroy of Egypt, and Sir Edward Codrington, for the evacuation of the Morea by the Turkish troops, in conformity with which the whole Egyptian armament sailed for Alexandria on the 4th of October; the resignation by the duke of Clarence, 12th August, of the office of lord-high-admiral, to which he had been appointed by Mr. Canning; the recal, in December, of the marquis of Anglesea from the government of Ireland; and the visit to this country, in the latter part of the year, of Donna Maria da Gloria, the young queen of Portugal. On the 26th of February, this year, Lord John Russell had carried his resolution in the House of Commons for the repeal of the Test and Corporation Acts, against the opposition of ministers, by a majority of 237 to 193. A bill to effect the object of the resolution was afterwards introduced, and ministers refraining from joining the opposition to it in the House of Lords, it was passed into a law. This measure had till now been uniformly resisted by both sections of the administration under which it was thus conceded.

The great measure of domestic policy of the year 1829 was the concession at last of Catholic emancipation. The consideration of the laws imposing disabilities on Roman Catholics, with a view to the practicability of their safe removal, was recommended in the king's speech, delivered at the opening of parliament on the 5th of February. The Relief Bill, and another abolishing the forty-shilling freeholders in Ireland, were brought into the House of Commons together by Mr. Secretary Peel, and read a first time on the 10th of March. The second reading of the Relief Bill was carried on the 18th by a majority of 353 to 173; on the third reading, 30th March, the numbers were, ayes 320, noes 142; the second reading in the Lords was carried 4th April, by a majority of 217 to 112; and the third reading on the 10th, by a majority of 213 to 104. Both bills received the royal assent on the 13th. Mr. O'Connell presented himself to take his seat for Clare on the 15th of May following; but after he had been heard at the bar, it was resolved by a majority of 190 to 116, that he [illegible] oath of supremacy; and on his refusal to take the said oath, a new writ was ordered to be issued for Clare.

In the early part of the year 1830 the king, who had for some time past lived in great seclusion, was attacked by an illness which soon assumed a serious appearance. After all prospect of his recovery had been for some time lost, he died at Windsor Castle on the morning of the 26th of June, in the sixty-eighth year of his age, and the eleventh of his reign. The same day proclamation was made of the accession of his late majesty king William IV.

Many important alterations of the laws were made in the reign of George IV., besides the great national measures that have been already noticed. Both the laws relating to the punishment and those relating to the trial of offences were consolidated and amended by several acts introduced by Mr. Peel, in which, and also in the general administration of the law, considerable progress was made in the application of the two great principles of diminishing the sanguinary character and increasing the certainty of punishments. Among the other legislative innovations of the reign may be enumerated, the act of 1823, abolishing the antient custom of burying persons who had committed felo-de-se in cross-roads, with a stake driven through their bodies; the Marriage Act Amendment Acts of 1822, 1823, and 1824; the act of 1824, for the restoration in blood of the representatives of the Scottish peers attainted in 1715 and 1745; the act of the same year for ascertaining and establishing a uniformity of weights and measures; the act of the same year for the repeal of the combination laws; the act of 1827 to prevent arrests upon mesne process where the cause of action is under 20*l.*; the act of 1828 for rendering a written memorandum necessary to the validity of certain promises and engagements; the act of th[illegible]ame year for regulating the importation of corn; the Metropolis Police Act of 1829; the act of 1830 repealing the beer duties; and the act of the same year substituting the punishment of transportation, instead of that of death, for forgery. The mention of these measures is sufficient to indicate the progress of legislation during the reign.

GEORGE I., surnamed the Long-handed, grand-duke of Russia, was the son of Vladimir Monomachos, who married Gyda, daughter of Harold, the last Saxon king of England. After the death of her father at the battle of Hastings, in 1065, Gyda retired to Sweden, from which country she married Vladimir, about 1070. It is however impossible to ascertain whether George was the son of the English princess, as his father was married three times; but it is very probable, as George died in 1157, at an advanced age. He was of a very ambitious and grasping cha-

racter, a circumstance from which he derived his surname, the *Long-handed*. Having received for his appanage the principality of Soozdal, situated in the north of Russia, he tried to establish himself on the grand-ducal throne of Kieff, which was possessed by his nephew Isiaslaf, and he succeeded in driving him from that principality (1149), but he was soon afterwards expelled himself by the Hungarians, who restored Isiaslaf. After many vicissitudes he attained his object, and became grand-duke of Kieff in 1155. He died two years afterwards. The reign of George is remarkable for the foundation of Moscow in a spot where, as the chroniclers relate, there lived a rich man named Koochko, of whose wife George became enamoured, and where, after causing the husband to be murdered, and having established for some time his residence there, he laid the foundation of a future city. George was very partial to the southern principalities of Russia, and being for a long time unable to possess any of them, he built several towns in his own dominions, to which he gave the names of those cities which were situated in the south; as for instance, Vladimir, Peryaslav, &c. His own dominions, inhabited originally by several Finnish tribes, living in an almost savage state, and being mostly idolaters, became civilized under this reign by the foundation of cities, churches, and monasteries.

George peopled the new towns with settlers of Sclavonian and Finnish stock, whom he attracted by granting them privileges and several other advantages. This is the origin of the population of Grand Russia, generally known under the name of the Muscovite or Soozdalian, which being a mixture of Sclavonians and Fins, exhibits a striking contrast in physical appearance, language, manners, and character to all the other Sclavonian populations. This people ought never to be confounded with the real Russians, who inhabit the south-western provinces of the present Russian empire, as well as Galicia, or Austrian Poland, and who, being of a pure Sclavonic race, much more resemble in every respect the Poles, the Slovacks of Hungary, and other people of Sclavonian race, than the population of Grand Russia. After the reign of George I., the northern principalities acquired great importance, and his son Andrew increased his power and established his residence at the town of Vladimir, which was built by his father on the banks of the Klasma. Instead of aiming at the possession of Kieff, which conferred the empty title of the Grand-Duke of Russia, and which was captured and sacked by his son and a coalition of other princes (1159), he assumed that title in his own dominions. He strengthened his power by exiling all his brothers, who found refuge at the court of the Emperor Manuel Comnenus. Andrew was murdered by some conspirators in 1174. After two years of civil war, during which Michel, prince of Rezan, for a short time occupied the throne of Vladimir, Vsevolod, brother of Andrew and son of George I., obtained the grand-ducal dignity, which he preserved till his death in 1212. His long reign was tranquil, and the chroniclers, who call him the Great, extol his justice also. Brought up at the court of the Greek emperor, where he spent his boyish years, must have had an education superior to that of his countrymen. He embellished his capital with splendid edifices, and fortified it as well as several other towns.

GEORGE II., son of Vsevolod and grandson of George I., became grand-duke, not immediately after the death of his father, but after that of his competitor, the Grand-Duke Constantine, in 1219. His reign is marked by one of tl most important events of the middle ages, which has produced the most decisive influence on the condition of Russia; we mean the invasion of the Moguls, the circumstances of which cannot be well understood without previously giving a short sketch of the state of Russia at the beginning of the thirteenth century.

The dominions of Vladimir the Great (who died in 1015) extended almost from the Baltic to the Black Sea, and from the frontiers of Hungary and Poland to the banks of the Volga, containing several tribes of Sclavonians in the south and the west, and of Fins in the north and the east, who were forcibly united under the dominion of the Varingian or Norman dynasty of Ruric, but divided by that monarch between his twelve sons. From that time the different principalities, although occasionally united, continued to be subdivided by several successive sovereigns, so that at the period in question there was a great number of minor princes besides the two great principalities of Vladimir in the north and of Halich in the south. The most important neighbours of Russia at that time were the nomadic nation of the Polovtzee, called by the Byzantine writers Comans, who established themselves, about the middle of the 11th century, in the countries along the shores of the Black Sea from the banks of the Don to those of the Danube. By their inroads they became formidable to all their neighbours, but particularly to the Russian princes, by whom they were also often hired as auxiliary troops. In 1224 the Mogul expedition sent by Gengis Khan under his son Joodgee Khan, to extend his conquests in the west, attacked the Polovtzee, whose chieftains, being defeated by the Moguls, fled to Russia, and entreated the Russian princes to assist them against an enemy, who, as they expressed it, 'has taken our country to-day and will take yours to-morrow.'

The Russian princes of the south, influenced by Motislaf, duke of Halich, listened to the Polovtzee, and having assembled an army of about 100,000 men, which was joined by great numbers of the Polovtzee, marched against the Moguls.

It was a wise measure to oppose the savage hordes before they had invaded the country, and the Russian and Polovtzee forces were sufficient to repel them; but dissension among the princes and the cowardice of the Polovtzee weakened the army, which was entirely defeated by the Moguls on the 31st of May, 1224, on the banks of the river Kalka (now Kalmius) in the present government of Ekterinoslaf, near the town of Mariopol. The Moguls after this victory extended their devastations as far as the banks of the Dnieper, but although no resistance was offered, they suddenly retired from the Dnieper into the deserts of central Asia, and their invasion produced on the minds of the inhabitants the effects of a supernatural apparition.

George II. had despatched an auxiliary force against the Moguls, but on their way they heard of the fate of the Russian expedition, and returned without meeting the invaders.

The Russian princes soon forgot the invasion of the Moguls, and instead of thinking of the possibility of their return, abandoned themselves to their usual broils and internal as well as external feuds. Nothing was heard of the Moguls till 1237, when a report was spread that they had invaded the country of the Bulgarians, situated on the banks of the Volga, in the present government of Kasan. It was Batoo Khan, grandson of Gengis Khan, who was sent by his uncle Oktay with 300,000 men in order to extend his conquests to the west, and with instructions to give peace only to the conquered nations. The report was followed by the appearance of the invaders, who entered the principalities of Rezan, and summoned its sovereign to submit and to give up the tenth part of all his and his subjects' property. The Duke of Rezan, with some minor princes, resolving to oppose the Moguls, sent a message to the grand-duke George requesting his assistance; but George relying on his own forces refused to join them, and decided on awaiting the approach of the enemy in his own dominions. The Moguls took and destroyed Rezan after a brave defence, and massacred the inhabitants. Moscow, Kolomna, and many other cities shared the same fate. George entrusted the defence of his capital Vladimir to his sons, and retired to a fortified camp on the banks of the river Sit. The capital was taken by storm in February, 1238, and every thing was destroyed with fire and sword.

George II., whose two sons perished at Vladimir, awaited the enemies in his position, and though attacked by an overwhelming force fought bravely till he was killed, on the 4th of March, 1238. The Moguls soon retired beyond the Volga, but in the next year they invaded Southern Russia, and having devastated a part of Hungary and Poland, penetrated as far as Liegnitz in Silesia, where they were repulsed in a battle with the Silesian dukes assisted by the Germans.

Batoo Khan returned to the banks of the Volga, where he summoned the Russian princes to pay him homag Resistance was hopeless, and the grand-duke Yaroslaf, brother to George II., was the first who acknowledged the sovereignty of the Grand Khan. This is the beginning of the Mogul or Tartar domination in Russia, which lasted till about 1470.

GEORGE, ST., surnamed of *Cappadocia*, was a native of Epiphaneia in Cilicia, and is said to have been born in a fuller's shop. From this obscure and servile origin he raised himself by the talents of a parasite, and the patrons whom he assiduously flattered procured for their worthless

dependant a lucrative commission or contract to supply the army with bacon. He accumulated wealth in this employment by the basest arts of fraud, and his depredations on the public purse at last became so notorious, that he fled from the pursuit of justice, taking his ill-gotten wealth with him. The place of his retreat was Alexandria, where he embraced, with real or affected zeal, the profession of Arianism. Here he formed a valuable library of history, rhetoric, philosophy, and theology, which the Emperor Julian, after St. George's death, appropriated to himself. So great had the influence of George of Cappadocia become amongst the disciples and followers of Arius, that when Athanasius was driven from Alexandria the prevailing faction elevated him to the vacant episcopal throne. Gibbon has enlarged upon the avarice and tyranny of his character whilst primate of Egypt. The Alexandrians, says Gibbon, could never forget nor forgive the tax which he suggested on all the houses of the city, under an obsolete claim that the royal founder had conveyed to his successors, the Ptolemies and the Cæsars, the perpetual property of the soil. The Pagans, who had been flattered with the hopes of freedom and toleration, excited his devout avarice; and the rich temples of Alexandria were either pillaged or insulted by the haughty prelate, who exclaimed in a loud and threatening tone, 'How long will these sepulchres be permitted to stand?' Under the reign of Constantius he was expelled by the fury, or rather the justice, of the people; and it was not without a violent struggle that the civil and military powers of the state could restore his authority and gratify his revenge. The messenger who proclaimed at Alexandria the accession of Julian, A.D. 361, announced the downfal of the archbishop. George, with two of his obsequious ministers, Count Diodorus, and Dracontius, master of the mint, were ignominiously dragged in chains to the public prison. At the end of twenty-four days the prison was forced open by the rage of a superstitious multitude, impatient of the tedious forms of judicial proceedings. The enemies of gods and men, observes Gibbon, expired under their cruel insults; the lifeless bodies of the archbishop and his associates were carried in triumph through the streets on the back of a camel. The remains of these guilty wretches were thrown into the sea; and the popular leaders of the tumult declared their resolution to disappoint the devotion of the Christians, and to intercept the future honours of these *martyrs*, who had been punished, like their predecessors, by the enemies of their religion. The fears of the Pagans were just, and their precautions ineffectual. The meritorious death of the archbishop obliterated the memory of his life. The rival of Athanasius was dear and sacred to the Arians, and the seeming conversion of those sectaries introduced his worship into the bosom of the Catholic church.

The reader who would enter into the history of St. George of Cappadocia as the patron saint of England may consult 'The Historie of that most famous Saint and Souldier of Christ Jesus, St. George of Cappadocia, asserted from the fictions of the middle ages of the Church and opposition of the present,' by Dr. Peter Heylyn, 4to. Lond. 1631 and 1633; 'A Dissertation on the Original of the Equestrian Figure of the George and of the Garter, ensigns of the most noble Order of that name,' by John Pettingall, 4to. Lond. 1753; and Dr. Pegge's 'Observations on the History of St. George, the Patron Saint of England,' in the 'Archæologia,' vol. v., p. 1-32.

When the English Crusaders went to the East in 1096, they found St. George received among the Christians as a warrior-saint, with the peculiar appellation of *Tropæophoros* (Τροπαιοφόρος) *the victorious*. They had some knowledge of him before as a saint and martyr, having read of him in that capacity in their Calendars and Martyrologies; and, after the succour which he was supposed to have afforded them at the siege of Antioch, they adopted him as the patron of soldiers. As such, Edward III. made him patron of the Order of the Garter; and he thus gradually became considered as the patron of chivalry, and the tutelar saint of England.

(Moreri, *Dict. Hist.*, tom. v., fol. Par. 1759: G. pp. 152, 153; Gibbon's *Decl. and Fall*, chap. xxiii.; and the *Acta Sanctorum of the Bollandists, Month of April*, tom. iii., p. 100-163: *De S. Georgio Megalo-Martyre.*

GEORGETOWN. [COLUMBIA, DISTRICT OF.]

GEORGIA. This article comprehends not only a description of Georgia Proper, but of all the countries between the Black and the Caspian Seas of which Russia either holds or claims possession, and which form dependencies of the government of Georgia, or, as the Russians call it, Grusia. This tract extends from 38° 31′ to 43° 30′ N. lat., and from about 41° to 52° 12′ E. long. It is enclosed on the north by the range of the Caucasus, which forms a part of the country; on the east it is washed by the Caspian, and on the west by the Black Sea; on the south it is bounded by Persia and Asiatic Turkey, having a line of frontier on that side of about 600 English miles. Its utmost breadth, from the Cape of Abcheron or Apsheron on the Caspian Sea, to the mouth of the river Chorokee, which falls into the Black Sea, is about 480 English miles; and its greatest length, from the banks of the Araxes to those of the Kooma, is about 500 English miles.

The countries on the eastern shores of the Black Sea were known to the early Greeks, as we infer from the history of the expedition of the Argonauts: and several Greek colonies, such as Dioscurias and others, were established here at an early epoch. The Romans became acquainted with the Caucasian regions during their wars with Mithridates and with the kings of Armenia. In the fifth, sixth, and seventh centuries of our æra those regions became the theatre of frequent wars between the emperors of the East and the Sassanide kings of Persia. In the eighth and ninth centuries they were partly conquered by the generals of the khaliphs of Bagdad, whose dominion however was not of long duration. From the eleventh to the end of the twelfth century the kings of Georgia acquired great power, and exercised a paramount influence over all the Caucasian isthmus. But their power was overthrown by the invasion of the Moguls of Gengis Khan, who overran these countries about the beginning of the thirteenth century, and rendered them tributary. Towards the end of the fourteenth century they were again invaded by Tamerlane, when they suffered even more than under Gengis Khan. After the death of Tamerlane the kings of Georgia expelled the Mohammedans and resumed their power; but the unfortunate division of the country which Alexander I., king of Georgia, made among his three sons in 1424, plunged it again into a miserable condition. About the beginning of the sixteenth century the sovereigns of Kakhet, or Eastern Georgia, became vassals to the sophis of Persia, and from that time were reckoned among the valees, or lieutenants, of the Shah. Towards the end of the same century the sovereigns of Kartli and of Imiretia, as well as all the western part of the Caucasian isthmus, fell under the domination, or at least the influence, of the Ottoman Porte; and the country between the Black and the Caspian seas became from that time a constant field of battle between the Turks and the Persians.

From the sixteenth century the czars of Moscow endeavoured to establish their influence in the Caucasian regions. Their projects were favoured by their community of religion with the Georgians, who repeatedly requested their assistance against the oppression of their Mohammedan neighbours. But the unsuccessful expedition which the Moscovites undertook in the beginning of the seventeenth century against the highlanders of the Eastern Caucasus stopped their projects of conquest in that quarter till the time of Peter the Great. This monarch in person made an expedition in 1724 against the highlanders of Daghestan, and took Derbend. This expedition was followed by a treaty with Tamas Shah of Persia, who, being driven from his states by the Afghauns, ceded to Russia, on the promise of being restored to his throne, the provinces of Daghestan, Shirvan, Ghilan, Mazanderan, and Asterabad. Although the promised assistance was never given, the provinces were taken possession of by Russia, and held till the year 1735, when they were restored by the empress Anne to the celebrated Nadir Shah.

The fortunes of Georgia were restored for a moment after the death of Nadir Shah, by Heraclius II., a Georgian prince, educated in the camps of that conqueror, whom he had accompanied on his expedition to India. After a long reign spent in constant wars with his neighbours, Heraclius adopted a measure which he thought would ensure the safety of his country, but which proved destructive to his dynasty. He declared himself in 1783 a vassal of Russia, which guaranteed to him and his successors not only the possession of his actual dominions, but even of those which he might thereafter conquer. Persia was at that time disturbed by internal wars and could not resent the desertion of her

vassal, but in 1795 Agha Mohammed Khan led an army into Georgia and defeated Heraclius, who, being abandoned by the Russians, tried to oppose the invaders with an inferior force. Tiflis was taken by the Persians, who destroyed the town and led a great number of its inhabitants into captivity. Heraclius died in 1798, and was succeeded by his son George XIII., a weak-minded prince, whose reign was constantly disturbed by a civil war with his brothers. George died in 1800. After his death Georgia was declared a Russian province, and the members of the reigning family were carried to Russia. A few years afterwards several provinces situated on the shores of the Caspian Sea were taken by the Russians, and their possession of them was confirmed by the treaty of Goolistan, concluded in 1813, between Russia and Persia. The sovereign of Imiretia, who had become a vassal of Russia in the beginning of the present century, made in 1810 an unsuccessful attempt to shake off his yoke; but he was obliged to flee to Turkey, and his principality was converted into a province of Russia. Several other petty states fell successively under the same power, whose conquests were extended during her last wars with Persia and Turkey, and confirmed by the treaty of Turkmanchay in 1828, with the first, and that of Adrianople in 1829, with the second of the above-mentioned powers.

The mountain-ranges of the CAUCASUS and of ARARAT are described under those respective heads.

The principal rivers which drain the Caucasian isthmus are the Koor, or antient Cyrus, the Araxes, the Rion or Faz (the antient Phasis), the Kooban, and the Terek, besides numerous smaller rivers and streams. Owing to the hilly nature of the country only two of these rivers are navigable, and that only for flat-bottomed vessels—the Koor, from its confluence with the Araxes to its outlet into the Caspian Sea, for about 70 English miles, and the Rion, for about the same distance.

The country, though generally mountainous, contains some extensive plains. The southern latitude of these regions and the high mountains by which they are surrounded and intersected produce that variety of climate which adapts them to the production of various plants and animals proper both to warm and cold climates. Of wild animals there are the panther, the jackal, the tiger, the bear, the wolf, &c. Besides the domestic animals common to the northern countries, there is a great number of camels and asses. A great variety of birds is found in these regions, of which the most remarkable is the pheasant, which is indigenous on the banks of the Rion, or Phasis, from which river it has derived its name. The slopes of the mountains are covered with large forests, which produce timber of the best description.

The vine, which is indigenous, grows abundantly in a wild state. The vineyards produce a great variety of grapes, and a large quantity of wine and brandy is made in the country. Silk is cultivated in several provinces, but this branch of industry is still in a very low state, owing to the unskilful preparation of that valuable commodity. The present annual exportation amounts to 15,500 poods. (A pood is about 36 lbs.) Cotton is grown in the southern provinces, but it is of very inferior quality, and the whole quantity exported is only 36,000 poods. It is however said that by an improved management the cotton might be brought to the greatest perfection, and its quantity increased to an unlimited amount. Madder grows spontaneously in several parts of the country, but is cultivated chiefly in the provinces bordering on the Caspian. The inhabitants of the district of Derbend are almost exclusively occupied with the cultivation of it. In 1832 they produced 35,000 poods of madder roots, valued at 47,000*l*. Rice grows almost everywhere except in the highlands; and saffron is produced in great quantities in the eastern provinces.

There is every reason to believe that great mineral wealth is concealed in the mountains, but hitherto nothing of any importance has been discovered. The present commerce of these countries by the Caspian Sea is carried on from the ports of Derbend, Baku, Shamakhi, and Lenkoran, to Persia and to Astrakan. The overland trade is with Russia and Persia, as well as with Asiatic Turkey. The commerce by the Black Sea is carried on from the mouth of the Rion with Odessa and other Russian ports, as well as with Constantinople; and there is a small traffic with the highlanders of the Caucasus.

The system of taxation is of the most oppressive and absurd character; and is rendered particularly vexatious by the numerous monopolies which exist in several places, and by the duties which are levied on goods passing from one province to another. These duties were established by the petty princes who formerly possessed the dominion of this country; but although the separate states are now united, the former customs and duties still remain.

The amount of the population is exceedingly doubtfu Of the several conflicting estimates the only one on which any reliance can be placed is the official returns of the population of some of the provinces entirely subject to Russia, and which we shall give under the special description of each.

The government of these countries is concentrated in the person of the governor-general, who resides at Tiflis, and who is at the same time commander of a considerable military force called the Caucasian corps. The governor-general determines all the civil and military affairs of these provinces, and directs the minor diplomatic relations with the neighbouring countries.

The ecclesiastical affairs of the Armenian church are directed by their patriarch, who resides at Echmiadzin; and those of the Georgian church by the Catholicos, or metropolitan of Georgia. The religious concerns of the Mohammedans are directed by a mooshtend, who is acknowledged by the Russian government as the religious chief of the Mohammedan inhabitants of the country.

The country is politically divided into the following provinces:—Georgia Proper, the Armenian provinces, the provinces of Daghestan, Akhalzik, Imiretia, the provinces of Shirvan, Sheki, Talish, and Karabagh. Besides these provinces, which are incorporated in the Russian empire, the following states acknowledge her sovereignty or claim her protection, although they are governed by native princes:—Mingrelia, Gooria or Gouriel, and some petty states in the Daghestan. Many highland tribes are only nominal vassals of Russia, and, instead of submitting to her commands, are constantly at war with her.

Georgia Proper consists of the former kingdoms of Kakhet and Kartli, which were united under the domination of Heraclius II., in the eighteenth century. It contains, according to official returns, together with the districts of Borchalin, Kasakh, Shamshadil, Bambaco-Shooraghel, and Elizabethpol, joined to it by the Russian government, and inhabited by Mohammedans and Armenians, a population of 225,395 males, inhabiting 61,201 houses, on a surface of 46,400 square versts.* The principal town is Tiflis, the antient metropolis of Georgia, and at present the seat of government for all the Caucasian provinces of Russia. It is situated in 41° 40′ N. lat., and 45° 16′ E. long., and extends along both banks of the river Koor for about 1½ English miles. In its external appearance it presents a striking diversity, produced by the mixture of Oriental and European civilization. The town is surrounded on the south and west by a ridge of barren rocks; and on the north, the Caucasus, with its snow-covered tops, is within sight. This contrast with the fertile valley in which Tiflis is situated amidst orchards and vineyards gives to the town a very picturesque and pleasing appearance. The population amounts to 26,000 souls, composed chiefly of Armenians, a much smaller number of Georgians, a few Mohammedans and German colonists settled in its immediate vicinity, besides the Russian troops, civil officers, and merchants. The inhabitants of Tiflis, Armenians as well as Georgians, bear a very bad character, and are said to have all the vices which are produced by long oppression, united with a greediness after gain. Such however is not the character of the Georgians of the country; and indeed a nation which has preserved its religion notwithstanding ages of persecution, and which has seized every opportunity of regaining its independence, has a just claim to some respect. The Georgians who inhabit the country have the reputation of being exceedingly attached to their religion and country, honest, simple-hearted, laborious, and brave. These honourable qualities are tinged with an admixture of vanity, irascibility, and some other defects common to less civilized nations.

The language of Georgia bears a great resemblance to the Armenian. The Armenian historians say that previous to the time of Alexander the Great, Georgia formed a part of Armenia, but was separated from it during the commotion produced in Asia by the wars of that conqueror and his successors; and that since that time the language of

* 1½ Russian versts are equal to 1 English mile.

Georgia has received an admixture of many foreign words. Besides the Armenian, which constitutes its basis, the Georgian is full of Greek, Latin, Persian, Arabic, Turkish, and other foreign words. The idiom of the Pshavi and other Georgian highlanders, who have had less intercourse with foreigners, is more free from this admixture, and much nearer to the language of the Georgian sacred books, which were chiefly written in the fifth century of our æra.

Georgia was converted to Christianity by Armenian missionaries, who introduced into the churches of this country the worship in the Armenian tongue, which however was not understood by the people. In 410 a learned Armenian named Mesrop invented an alphabet for the Georgians, and soon afterwards the Bible and other religious books were translated into the Georgian language. A new kind of letters, used for ordinary writings, were invented about the 10th century, which are distinguished from the old characters by a greater simplicity; the difference between the two alphabets may be compared to that which exists between the Gothic and the present Latin letters. The new alphabet is called by the Georgians Mkhedroolee, or the Military one, and the old one Khootzoora, or the Ecclesiastical. Although fourteen centuries have passed since the Georgian language had an alphabet, it is not yet subject to definite rules. It has a dictionary, although a very incorrect one, and there are also some treaties on grammar and rhetoric, imitated from the Persian and Armenian, and in modern times from the Russian. But there is no real Georgian grammar, except some elementary works, written by foreigners, in order to facilitate the learning of the language. Such are the Georgio-Italian dictionary, published at Rome in 1629, by Stephen Paulini and Nicephorus Irbacchi. A Georgian grammar was also published there by Mogius in 1760. In 1820 there appeared at St. Petersburg a Russo-Georgian grammar. A printing-office was established at Tiflis by King Archil in the middle of the 17th century, and some religious books were printed there. Under Vakhtany the Sixth, who published a code of laws, many works were also printed, and their number was still increased under the reign of Heraclius the Second. The printing establishment was destroyed at the sacking of Tiflis by the Persians in 1795. The Russian government has now established a printing-office with Georgian, Persian, and Russian letters.

The population of Georgia is divided into the following classes:—1st. The Tavadis (literally heads), who constitute the higher nobility. 2nd. The Asnauris, or nobles. 3rd. The Mokalaks, or citizens (from Kalakh, a town) 4th. The Glekhs, or peasants. The Russian government in taking possession of Georgia gave to the Tavadis the title of princes, and to the Asnauris that of nobles. Both these classes have in Russia the same privileges as the nobles of that country, and have the same right to possess serfs.

Before the Russian dominion was established, the Tavadis were divided into three classes, distinguished by the sum of money paid for the murder of an individual belonging to their body. Thus the sum paid for the assassination of a Tavadi of the first class was double of what was paid for one of the second: and the penalty for the murder of a Tavadi of the second class was double of that for one of the third class. The Asnauris were likewise divided into three classes, which stood in the same relation to each other as those of the Tavadis. There were instances of some Asnauris being subject to the Tavadis, to whom they were given into hereditary bondage by the sovereign.

The Mokalaks, or citizens, live in the towns, and chiefly at Tiflis. They are generally engaged in trade, and their whole body pays to the government a fixed sum which they assess upon themselves. The peasants are serfs in Georgia, and belong either to the crown, the church, or to the princes and nobles.

The other towns of Georgia are, Signakh, the chief place of the district of that name, with about 3000 inhabitants; Telav, a well-built town in the Oriental style, with more than 3000 inhabitants; Doochet, a fortified place, with about 1300 inhabitants; Goree, a commercial town, with about 3500 inhabitants; and Elizabethpol, or Ganjah, formerly the capital of a Khanat, and the residence of a vassal prince. Elizabethpol is a large town, which contains even now, in its dilapidated state, 2000 houses, with above 6000 individuals, and several fine mosques and other public buildings. The town is fortified, and has been frequently exposed to the calamities of a siege and capture. All the towns enumerated are capitals of districts, which are called after them.

The administration of Georgia consists of three departments, executive, financial, and judicial, the heads of which, with the addition of some inferior magistrates, form, under the presidency of the governor-general, the supreme council of Georgia. Civil cases are decided according to the code of Vakhtany, the sixth king of Georgia. When its provisions prove insufficient recourse is had to the Russian law, by which all criminal cases are decided.

There is at Tiflis a school supported by the government, one by the Armenians, and an ecclesiastical seminary for the education of the Georgian clergy.

Imiretia.—It has been already mentioned that Alexander I., king of Georgia, in 1424 divided his dominions among his three sons; he gave Imiretia to one of them. The various fortunes of this little country, which fell under the dependence of Turkey in 1576, present too little interest to require mention.

Imiretia is situated between 41° 45′ and 42° 40′ N. lat., and between 42° 9′ and 43° 39′ E. long. On the north it borders on the main ridge of the Caucasus, and is separated on the east by a branch of it from Georgia Proper; on the south it borders on Akhalzik; and on the west on Mingrelia. Its area is calculated to be about 9200 square versts. Being sheltered from the northern winds by the Caucasus, its climate is mild, and in many parts the trees blossom and produce fruit twice a year. The large forests with which the country is overgrown prevent the free circulation of air, and engender a kind of malaria. The soil is exceedingly fertile, and the climate favourable to the cultivation of all the products of warm countries. Its population, which amounts to 100,000, consists chiefly of Imiretians and a few Armenians. The Imiretians speak a dialect of the Georgian language, and are politically divided into the same classes as the Georgians. Their manners and customs are also the same. The lower classes are very laborious, and remarkable for their physical strength. Many of them go to Tiflis to gain a livelihood by their labour. The government is vested in a Russian general, who commands the military force stationed in Imiretia, Mingrelia, Gooria, and Abkhazia, and who is dependent on the governor-general of Georgia. He presides over the civil department, which is composed of three Russian and two native magistrates, called Divan Begs. This department decides on all civil cases, and superintends the administration of the finances. Criminal cases are decided by a military commission. Civil affairs are decided according to the code of Vakhtany, and whenever it is defective recourse is had to the Russian law. Criminal cases are judged exclusively according to the Russian law. Every district is governed by a Russian intendant, assisted by two native officers.

Imiretia is divided into four districts: Kootais, Vakee, Shoropan, and Rachee.

Kootais, on the Rion, the metropolis, and the only town of Imiretia, was formerly the residence of its kings, and is now the seat of the Russian government. It is the capital of the district of the same name, as well as of the whole country. The place is divided into the old and new town, the former of which is of great antiquity, and contains a church built in a splendid style of Byzantine architecture. The new town is constructed in the European manner, and its streets are planted with nut, fig, and other trees. The number of inhabitants, exclusive of the Russian garrison, is only 2000. In the neighbourhood of Kootais is the monastery of Ghelat, which is surrounded by mountains containing sulphur springs, naphtha wells, and also a kind of black amber.

Akhalzik.—By the treaty of Adrianople Turkey ceded to Russia a part of the pashalik of Akhalzik which now forms the Russian province of that name. On the north it borders on Gooria, Imiretia, and Mingrelia; on the east, on Georgia; on the south, on the pashalik of Kars; on the south-west, on the part of Akhalzik which has remained under the Turkish domination. It is situated between 41° and 42° N. lat., and between 42° 39′ and 44° 1′ E. long. Its area is more than 7000 square versts.

The country is generally hilly, but very fertile, and the climate is healthy. The mountains contain numerous mineral springs, many of which have medicinal properties. The population, which amounts to 7000 souls, consists of Armenians, Georgians, Greeks, Koords, Turks, Jews, and Gipsies. The country is divided into ten sandjacs, or districts, some of which are governed by Russian officers,

and others by natives called sandjac-begs, who, instead of a salary, receive the revenue of certain estates, as was the case under the Turkish dominon. They all however depend upon the Russian governor residing at the town of Akhalzik.

The principal towns are: Akhalzik, the capital of the province, a fortress supposed to have been built by the celebrated queen Thamar. It contains 13,500 inhabitants. Akalkalaki, also a fortress, has 1000, and Khertvis 600 inhabitants.

The *Armenian provinces* are composed of the khanats of Erivan and Nakhichevan, ceded to Russia by Persia in 1828. [ERIVAN.] They contain a surface of about 11,000 square versts, a great part of which is hilly, besides the mountain of Ararat. There are however many plains with a very fertile soil. The products of Erivan are the same as those of Georgia, but with the addition of a kind of cochineal, called by the natives red worms, and which, according to Mr. Hamel (a learned naturalist), are a kind of insect which has never yet been described. They are much larger than the American, and are found on the roots of a plant called by Baron Marshal Biberstein ('Flora Tauro-Caucasica') *Poa pungens*, and by the Academician Trinius *Æluropus lævis*. Mr. Hamel maintains that this is as fit for dyeing purposes as the American cochineal. Though its use is now exceedingly limited, it may become a very important article of commerce. The population, according to the official returns of 1834, consisted of 22,336 families, containing 65,300 males, of whom 29,690 were Mohammedans, and the rest Armenians.

Besides the town of Erivan, the most remarkable places of the province are, the important fortress of Sardar Abad, and the convent of Echmiadzin, the residence of the Armenian patriarch.

The province of Nakhichevan, which forms the south-eastern part of Russian Armenia, is divided into two districts: Nakhichevan, and Ordoobad. The former contains about 3000 square versts, inhabited by 6538 families, of whom 2678 are Armenians, and the rest Mohammedans. According to the official returns of 1832, the number of males was 16,095. The climate of the hilly part of this district is healthy, but in the plains it is exceedingly hot and unwholesome. It contains some valuable salt mines. The town of Nakhichevan, situated in 38° 59′ N. lat., was in antient times one of the most important cities of the Armenian empire, and the Persian historians relate that it then contained 40,000 houses. It has been many times captured and sacked, yet when it was visited by Sir John Chardin, in the seventeenth century, it contained 2000 houses, besides numerous caravanserays, baths, and other public buildings. Extensive ruins attest the former grandeur of that city, which has now a population of only 1330 families, comprehending 2870 male individuals, although the circumference of the town is about four English miles. Not far from Nakhichevan is the fortress of Abbasabad, constructed on the left bank of the Araxes by some French engineers in the Persian service.

The district of Ordoobad contains about 1200 square versts, inhabited by a population of 3160 males, of whom 2157 are Mohammedans, and the rest Armenians. The district of Ordoobad being very fertile and enjoying a particularly healthy climate, has been named 'the earthly paradise.' The chief place of the district is Ordoobad, which contains about 600 houses.

The Mussulman Provinces.—A large tract of land extending along the shores of the Caspian Sea, and containing the present provinces of Baku, Derbend, Shirvan, Kooba, Sheki, with the peninsula of Apsheron and the island of Salyan, once formed a part of Albania, which belonged to the powerful monarchy of Armenia till the sixth century, when being conquered by the Sassanide monarch of Persia, Khosroo Nooshirvan, it assumed the name of Shirvan. For some time afterwards it had its independent sovereigns, who took the title of Shah, but were obliged, towards the end of the ninth century, to acknowledge the supremacy of the khaliphs.

The rulers of Shirvan long continued powerful, and had frequent wars with Persia. In the beginning of the fifteenth century, Emir Ibrahim of Shirvan conquered Azerbijan, took Tauris, and even Ispahan, the capital of Persia. But the terrible revolutions which agitated that country, towards the end of the fifteenth century, brought it under the dominion of Persia, and Shirvan never recovered its independence. Divided among several rulers nominated by the Shah, it remained under the dominion of Persia until it was gradually invaded and finally subjugated by Russia.

Shirvan borders on the province of Kooba on the north; on the east, on that of Baku and the Caspian Sea; on the south, on a bay of the same sea, and the provinces of Talish and Karabagh; and on the west, on the province of Sheki. The surface of the whole province, including the island of Salyan, is estimated at 14,500 square versts. It contains many plains, and, except in the mountainous part, is exceedingly fertile. The climate in the plains along the shores of the Caspian is very hot and unhealthy, but this high temperature, with the great fertility of the soil, renders it capable of producing many tropical plants.

The bulk of the population of Shirvan consists of the Tahtar, or, to speak more correctly, Turkish race, with some admixture of Arabs and Persians. It may be divided into several classes; as the begs and agas, or nobles, the clergy, the maafs, the maaf-nookers, and the peasants. All these distinctions originated under the former native governments, and are rather connived at than maintained by Russia. The begs are the landowners, to whom the peasants living on their lands are obliged to make certain payments in money, and others also in kind or in labour. The dignity of the beg was granted by the sovereign, and continued in the family more by custom than by law. The title of aga is given to those individuals who are descended from the families of the khans. The clergy enjoy great consideration among the natives, being the expounders of the Koran, by which not only the religious but the civil concerns of the Mohammedans are regulated. The maafs are individuals exempted from every tax and duty, generally only for a certain period. This immunity was acquired either by some services rendered to the khans or by purchase. The maaf-nookers were exempted from the payment of every kind of taxes, but were under an obligation to serve the khan in the field, and to perform certain services, such as the carrying of despatches, collecting imposts, &c. The peasants are all free, and there are no serfs among the Mohammedans of the Caucasian provinces. The merchants, artisans, and other inhabitants of towns pay no direct taxes to the government, but are obliged to provide military quarters, horses, or cattle for military transport, and to contribute to the maintenance of public buildings, &c. Besides the Mohammedans, who form the mass of the population, there are many Armenians, some Jews, and a few Gipsies. According to the official returns of 1831, the number of males belonging to the Mohammedan population was 62,934; Armenians, 6,375; Jews, 332: total males, 69,641.

The prevalent language of Shirvan is what is there called Toorkee or Turkish, which is also used in Azerbijan.

The principal products of Shirvan are rice, silk, wine, some cotton, and tobacco. The climate, particularly of that part which is called the Island of Salyan, and which is in fact the Delta of the Koor, is so warm and so fertile that it would produce in the greatest abundance many tropical plants, but its natural advantages have hitherto been turned to little account. This island has also rich fisheries, which bring in to the government, on an average, an annual revenue of about 28,000*l*. The industry of Shirvan consists chiefly in the manufacture of silken stuffs, which are concentrated in the town of Old Shamakhee and some villages in its vicinity, and which occupy about 700 looms, each requiring the co-operation of four individuals. There are also some cotton manufactures as well as a few tanneries in the same place. The district of Laguish, which is situated in the mountains and in a very cold and barren region, is inhabited by a population entirely distinct from that of the rest of Shirvan, who are exclusively employed in the fabrication of arms, copper vessels, and sundry metal wares, from which they derive considerable profit, as is apparent from their condition being superior to that of the rest of the inhabitants of Shirvan. The commerce which is carried on with Persia by the Caspian Sea, and with Astrakan and Tiflis overland, is not considerable.

The chief place of the province is the town of Old Shamahkee, which was celebrated for its trade during the middle ages, when it was the chief mart and the centre of that commercial intercourse which we have already described. It continued to be an important city, notwithstanding the change of the above-mentioned commercial route, as well as many political vicissitudes; and it was in

the most flourishing condition at the beginning of the eighteenth century, when it was sacked (1717) in the most barbarous manner by the highlanders of Daghestan. Since that time Shamahkee has never recovered its antient splendour, and it is now inhabited, according to the official returns of 1832, by only 2233 families.

The khanat of *Talish*, being situated between 38° 31′ and 39° 31′ N. lat., is the most southern possession of Russia. On the north it borders on the steppe of Moghan, which makes part of Shirvan; on the east, on the Caspian Sea; and on the south and west it is enclosed by the Persian dominions. This province is entirely mountainous, with the exception of one great plain, which runs between the mountains and the sea, and contains about 3000 square versts. Its soil, with few exceptions, is a black loam capable of producing the most luxuriant vegetation. This richness of the soil, combined with a hot climate and abundance of water, renders it practicable to cultivate various tropical products on the plain of Talish; and many persons who have examined the country consider that the sugar-cane, cotton of the finest quality, indigo, and the orange-tree, &c., would succeed perfectly; while the slopes of the mountains are very favourable to the cultivation of the vine, as well as the almond, olive, and other trees which require a dry soil. At present the state of agriculture is very low, and the greatest part of the grounds are only used as pastures.

The climate, which is now rather unhealthy on account of the great number of marshy grounds, may be improved by draining these swamps, which contain an extraordinary quantity of snakes and other venomous reptiles. It is a great advantage to the khanat of Talish that it is situated along the sea-coast, which offers great facilities to its commerce. It has two ports, or rather roadsteads: Lenkoran, which is so shallow that vessels can never approach the coast nearer than one mile, and are frequently obliged to anchor even at a greater distance; and Sara, which is the best port in the Caspian Sea. Sara is situated on the north-western side of a little island of the same name, and is about 2½ English miles from the shore. Vessels drawing 14 feet water can come within 150 fathoms of the coast. It is the usual station of the Russian war flotilla.

The population of the khanat of Talish is of the same description as that of the province of Shirvan, and all that we have said respecting it is applicable to the inhabitants of Talish. The amount of the population seems not to have been exactly ascertained. There are some few wandering tribes, who live in a very wild state, and are much addicted to predatory habits. The industry of Talish is in a very low state, and limited to the production of some silk, rice, honey, &c. The manufactures supply a few silk and cotton stuffs. The chief and only town of the province is Lenkoran, in 38° 43′ N. lat. and 48° 54′ E. long. It is a wretched place, with about 500 houses.

The province of *Karabagh*, which is separated on the south by the Araxes from the Persian dominions, and enclosed on all other sides by the Russian provinces of Shirvan, Sheki, Elizabethpol, Nakhichevan, and Erivan, has an area of about 13,000 square versts. From its extensive forests, it has received the name of Karabagh, which signifies, in the Turko-Tahtar language, 'a black garden.' Many parts are covered with hills; the highest, called Saree Dara, is 5000 feet above the level of the Caspian. These hills are generally covered with wood or fine grass, and barren rocks are very rare. There is a great plain which contains about 2400 square versts, and a soil almost universally fertile; even the greatest part of the hills are covered with a black loam. The climate in the high parts is rather cold. The plains are hot and unhealthy. Besides the Koor and the Araxes, the province is drained by a great number of small rivers and mountain streams, which afford great facilities for irrigation. The products of Karabagh, owing to the hilly character of the country, are those of a moderate rather than a warm climate, and the forest-trees are of the same description as those of Europe, and supply timber of the best quality. The mineral products consist of a small quantity of naphtha, copper, and salt, collected from lakes.

The population of Karabagh, according to the official returns of 1832, consisted of 13,965 Mohammedan and 1491 Armenian families, besides some Nestorian Christians and Gipsies. This limited population may be ascribed to the frequent wars which have long desolated the province, and to the emigration to Persia of many Mohammedan families since its subjection to Russia, although many Armenians were induced by the Russian government, after the peace of Toorkmanchay, to emigrate from Persia to Karabagh.

All that has been said of the Mohammedan population of Shirvan and Talish is equally applicable to that of Karabagh, with the exception that, besides the two Mohammedan sects of the Shiites and Soonnees, there is a third, called Aliallaga. Its followers are distinguished, besides a particular veneration for Ali, by abstinence from tobacco and snuff, which is carried so far, that they shun the intercourse of those who make use of them; but they drink wine and distilled liquors.

The Armenians of Karabagh have a nobility, consisting of some families to whom Shah Abbas the Great granted the title of melihks or princes, which is enjoyed by their descendants. They have a numerous clergy, comprising two archbishops, many bishops, abbots, and several convents, besides the secular clergy. Both clergy and laity are very ignorant, and their religious observances are much relaxed. Anybody who is married to a virgin, and is able to read, may become a priest by remaining in a church, or a room attached to it, during forty days and nights, and reading the Scriptures. Having passed this probation, he is consecrated by the local bishop; but should the priest, after having lost his first wife, marry again, he loses his sacred character. The Armenians of Karabagh have intermingled with their religion many Mohammedan and even Pagan rites and customs. They are called to the church by a public crier, and enter it without uncovering their heads. At the baptism they give Mohammedan names to their children, and sacrifice several kinds of animals and birds to the saints at the entrance of churches. The Nestorians have emigrated into Karabagh from Persia since the treaty of Toorkmanchay.

The only town in Karabagh is Shooshee, situated on a high rocky mountain, about 4000 feet above the level of the Caspian. It is fortified by nature and a little by art: it contains about 1700 houses. The population is composed of 762 Armenian and 936 Mohammedan families. The Missionary Society of Basel has an establishment at Shooshee, composed of a few missionaries, who maintain gratuitously a school for the natives, where, besides the Christian religion, are taught the Armenian language, arithmetic, and geography, as well as the Greek and English languages. The missionaries have also a small printing-office, in which they print some religious tracts and school-books in Armenian. There are also two Armenian schools, one for boys, and another for girls; and 7 Mohammedan schools, besides one established by the Russian government.

The province of *Sheki* is situated between 40° 10′ and 41° 16′ N. lat., and 45° 56′ and 48° 7′ E. long. On the north it borders on a part of the Caucasian ridge called Salvat-dagh and Shak-dagh, by which it is separated from several independent tribes of the Lesghis; on the east on the province of Shirvan; on the south on that of Karabagh; and on the west on the territory of the sultan of Elisooy and the district of Elizabethpol. Its length from north to south is something more than 70 English miles, and its breadth in the northern part about the same; but it narrows towards the south. The surface is calculated at about 9000 square versts. The country is generally mountainous, but there are also some level tracts; the climate is temperate, except during the few summer months, when the heat becomes oppressive in the plains. The products consist of different kinds of grain, which are cultivated in the hilly part. Silk is produced in the plains: this latter branch of industry has of late made great progress, and may become very important by the improvements introduced into the preparation of the silk by an establishment for preparing it after the European manner, which was made by the government in 1829. Some cotton is also cultivated in the plains; but although circumstances are favourable to its growth, it is now produced to a very small amount, and of a rather inferior kind. Some silks of a good quality are manufactured by the women in several villages. Great flocks of sheep and cattle are reared in the province.

The population of Sheki amounts, according to the official returns of 1833, in the town of Nookha, and 270 villages, or nomadic encampments, to 21,264 families, consisting of 55,773 males. This number comprehends 46,300 Mohammedans, 8938 Armenians, and 485 Jews. What has been said about the Mohammedan and Armenian

populations of the other provinces is applicable to those of Sheki. The Jews are engaged in a petty retail trade.

Nookha, the chief place of the province, contains about 6000 inhabitants. It is in a valley, inclosed on all sides by mountains, a circumstance which prevent a free circulation of air, and accounts for the unhealthiness of the place. Sheki, which is now a small village, must have been a considerable place, since it has given its name to the whole province. Fit-dagh, a little fortress situated on a mountain of the same name, has naturally a very strong position, and in former times served as a place of refuge to the khan, when he was defeated by his enemies.

Baku is on the shores of the Caspian Sea, between 48° 9′ and 50° 12′ E. long. A great part of this province is formed by the peninsula of Apsheron, which juts into the Caspian Sea. Its surface is calculated at about 2800 square versts; the soil is generally poor, and the climate, although hot, is not unhealthy. Among the natural productions of the province, the most remarkable is naphtha or petroleum, which is found in great quantity close to the shores of the Caspian. It is drawn from wells dug in the ground. There are two kinds of naphtha, the white and the black: it is exported to Persia, and partly consumed in the Caucasian provinces, where it is used for lighting the houses. There are many salt lakes on the peninsula of Apsheron, which furnish a great quantity of salt. The population, according to the official returns, amounts to 15,128 male individuals. They are generally Mohammedans, of the Shiite sect; all that has been said about the manners and customs of the inhabitants of other Mohammedan provinces is equally applicable to them. They are however more industrious than the other Mohammedans, and are in a comparatively better condition. The active commerce which is carried on by Baku on the Caspian Sea greatly favours their industry. [BAKU.]

The province of Kooba borders on that of Baku on the south. It contains a surface of about 10,500 square versts. The western part of the province is hilly; but there are extensive plains of the most fertile soil along the shores of the Caspian. The climate is rather cold in the mountains, but warm in the plains. The country produces in abundance every kind of corn, with some rice, cotton, silk, and tobacco. Numerous flocks graze on the rich pastures. The population, according to the official returns of 1832, amounts to 46,094 males, who are Mohammedans. Kooba, the capital, and the only town of the province, contains about 650 wretched houses, built in an irregular manner.

Derbend has already been described. [DERBEND.]

All the above-mentioned provinces are governed by Russian military commanders.

Having described the Russian provinces which constitute the government of Georgia, we shall give a brief sketch of those countries which, having preserved their national rulers, acknowledge the supremacy of Russia, and are dependent on the governor-general of Georgia.

Mingrelia.—This principality, which extends along the banks of the Rion, or Phasis, was well known in antiquity under the name of Colchis. It became subject to the Romans; and after the capture of Constantinople by the Latins formed a province, or at least a dependency of the empire of Trebizond. The Turks took possession of it in the latter part of the fifteenth century, but left the government to the native princes, who continued vassals of the Porte till the treaty of Kaynargee in 1774, between Russia and Turkey, by which Mingrelia was declared independent. In 1804, George Dadian, prince of Mingrelia, acknowledged himself a vassal of Russia; and his son and successor Levan Dadian (Dadian is their family name), a Russian lieutenant-general, is the present ruler of that country.

Mingrelia lies between 42° and 43° N. lat., and 41° 19′ and 42° 19′ E. long. On the north it borders on the Caucasian range, on the west on Abkhazia and the Black Sea, on the east on Imiretia, and on the south on Gooria. Its greatest breadth is 60, and its length about 75 English miles. Its surface is calculated at about 10,000 square versts. The soil, climate, and productions are the same as those of Imiretia. The population amounts to 90,000 souls, and consists of Mingrelians and Souanets, with a few Abkhazians, Armenians, and Jews. The Mingrelians speak a dialect of the Georgian language, and profess the Greek religion. They have an archbishop and three bishops, subject to the spiritual supremacy of the Catholicos of Georgia. Their political divisions, and their manners and customs, are the same as those of Imiretia. The country is divided into three districts, called Sennakh, Legchoom, and Zoogdeet, and the territory of the Souanets, who are a highland tribe professing partly the Mohammedan religion, but their manners and customs are very little known. The little town of Sennakh is the chief place of the country, and the residence of the sovereign. Russia possesses on the coast the fortresses of Redout-Kale and Anaklia.

The principality of *Gooria* has long been governed by its own sovereigns, who are descendants of the Georgian dynasty, and have been vassals to the Ottoman Porte since the 16th century. In 1810 its ruler became vassal of Russia. He left on his death a son, a minor, to whom the succession to the throne was confirmed by the Russian government, under the regency of his mother, the Princess Sophia, with a Council of the first nobles of the country. The Princess Sophia, not being satisfied with the Russian protection, opened negotiations with the Turks in order to get rid of it. Her intentions were discovered, and she was obliged to flee with her son to the Turkish dominions. Since that time the government of the country has been intrusted to the abovementioned council of nobles, with a Russian field-officer at its head, and dependent on the Russian commander in Imiretia.

Gooria lies between 41° 40′ and 42° 5′ N. lat.; it is bounded on the north by Mingrelia, on the west by the Black Sea, on the east by Imiretia, and on the south by the Turkish possessions.

It contains about 1800 square versts. The country is very hilly, and covered with large forests, containing excellent timber for ship-building. The soil is exceedingly fertile; the products are the same as those of Imiretia and Mingrelia. The population, which consists of Georgians, and some Armenians, amounts to 36,700 souls. The population is divided into classes of princes, nobles, &c., as in Georgia.

The religion is Greek, and the church establishment consists of an archbishop and two bishops, under the spiritual superintendence of the Catholicos of Georgia. The country is divided into two districts, Ozoorget and Nagomar, each containing a little town of the same name. The most important place is the Russian fortress of Poti, at the mouth of the river Rion. It was taken by the Russians in 1[illegible] but was restored to the Turks at the peace of Bucharest in 1812. It was again captured by the Russians during the last war, and ceded to them by the treaty of Adrianople in 1829.

A general sketch of Daghestan has already been given. [DAGHESTAN.]

We shall here add a few particulars about the petty states which acknowledge the supremacy of Russia, and are considered as part of that empire.

The possessions of the Shamkhal of Tarkoo, which contain about 40,000 souls, extend along the Caspian Sea. The Shamkhal, although a vassal of Russia, governs his possessions with unlimited power. His dignity dates from the time when the Arabs conquered the country; and the name is Arabic, signifying 'the Syrian prince' (from *Sham*, Syria, and *khal*, prince). The Shamkhals had been for some time vassals of Persia, and had the title of Valee of Daghestan. They have several times acknowledged the supremacy of Russia, but it is only since 1786 that they have become permanently her vassals. Tarkoo, the capital of the Shamkhal's dominions, situated near the Caspian, contains a population of 8000 souls. Near it is the fortress Boornaya, which is garrisoned by Russian troops. The supremacy of the Shamkhal is nominally acknowledged by the Lesghian tribe of Acoosha, which is a kind of republic composed of about 10,000 families, who are much addicted to predatory habits, and are ready to enter the service of any body who will pay them. They never attack the Shamkhal, on whose pastures they are permitted to graze their flocks. Having revolted, they were defeated by the Russians in 1819, and since that time have remained tranquil.

The other vassal princes of Russia in those parts are the Ootsmey, or prince, of the Karakaydans, who rules over a population of about 69,000 souls; and the Cadee of Tabasseran, having a population of about 50,000 souls.

Lesghistan, or the country of the Lesghis.—The Lesghis inhabit a country situated between Daghestan, Georgia, the Caucasus, and the provinces lately acquired from Persia. The whole surface of their country is calculated

to amount to 20,000 square versts. Klaproth is of opinion that the tribe of Avars, which is the most important among the Lesghis, are descended from the antient Avars, who were a branch of the Huns. There is a great admixture amongst the Lesghis of Arabian blood, from the colonies which were settled there in the ninth century by the caliphs of Bagdad. Like all the Caucasian tribes, the Lesghis are of a savage character, and given to robbery. They are exceedingly brave, and capable of enduring the greatest hardships. They are most accomplished horsemen, but fight equally well on foot. They are always ready to sell their services to the highest bidder. The general price paid to an armed horseman is about 2*l.* for one expedition, which never lasts longer than four months. Besides this pay, the horseman receives victuals and forage. The Lesghi, who at home never obeys any body, strictly conforms during the war to the orders of the chieftain under whom he has engaged to serve. Before the occupation of the Caucasian Isthmus by the Russians, the friendship of the Lesghis was sought by all the petty princes who were at war with their neighbours, and those who had secured the alliance of these warlike highlanders were sure of success. By their depredations the Lesghis became the terror of the adjacent countries, and Georgia was particularly exposed to their inroads. It is generally towards the end of the month of May that the Lesghis leave their mountains and enter Georgia; they usually disperse in small parties, and conceal themselves in woods, caverns, or old ruins, watching a favourable opportunity to make captives. Having carried their prisoner to a place of safety, they send to inform the relations that they may redeem him on paying a sum equal to about 35*s.* Should the prisoner be a man of consequence, the ransom is much higher. The life of every prisoner depends on the will of his captor, but as soon as he enters his house he must no longer be killed. The prisoner who has not the means of paying his ransom is obliged to serve his master for ten years.

The majority of the Lesghian tribes profess the Mohammedan religion of the sect of Soonnee: there are however many who seem to have no religion whatever, while some f them have preserved a few faint vestiges of Christianity. Hospitality and the law of retaliation are the only social bonds among this people.

The khan of the Avars is the most powerful prince among the Lesghis. He rules over 270 villages, inhabited by a population of about 100,000 souls. In case of need he can raise an army of 10,000 men. The kings of Georgia used to pay him an annual tribute of about 1000*l.* He long maintained his independence against the Russians, and it was only in 1828 that he acknowledged himself their vassal. The other Lesghian tribes who acknowledge the supremacy of Russia are the Kazockoomooks, whose population amounts to 20,000 souls, the Djaro-Belakans, and the principality of the sultan of Elisooy. Several Lesghian tribes, who have a republican form of government, have preserved their independence. The most remarkable of them is the little community of Koobichee, which consists of about 1000 families, who inhabit a large village and a few small ones situated in a strong position. They are known all over the East by the name of Zerkers, or manufacturers of mail shirts. Some authors think that they are descendants of a European colony, but it has been proved by recent researches that their language is a dialect of that of the Lesghis, whom they resemble in many respects. They make arms of a very superior description, which, as well as their cloth, have a great reputation, not only in the adjacent countries, but also in Persia, and even beyond the Caspian Sea. It is indeed very remarkable to find in the midst of the savage tribes that inhabit these highlands an industrious and laborious population.

The Koobichees do not engage either in agriculture or the rearing of cattle, but they exchange the objects necessary to them for the products of their industry. Their friendship is sought by all the Lesghian tribes, whom they furnish with arms; but the Koobichees are always on their guard, and strictly watch the only two passes by which their country is accessible, and which they have fortified with small cannons. They are never at war with their neighbours; they pay neither taxes nor tribute, and are governed by a council of twelve elders, chosen by themselves.

The Highland tribes of the Mitsdjegi, or Kistes, are divided into four branches—1, the Kistes Proper; 2, the Ingooshes; 3, the Karaboolaks; 4, the Chechenzes.

1. The Kistes Proper are now a very small tribe, composed of about 1500 souls. They are subject to the Russian dominion, and maintained in their allegiance by the military line which crosses their country.

2. The Ingooshes are the most peaceful tribe of this nation, and more inclined to agriculture and sedentary occupations. Their population is about 4,500 families, now entirely subject to the Russian government.

3. The Karaboolaks were formerly one of the most formidable tribes of the Caucasus, and had long oppressed all their neighbours, till at last they were almost exterminated by a league of the surrounding tribes, excited by the wrongs which they had suffered from them. Their feeble remains acknowledge the Russian dominion, although they never lose an opportunity of committing depredations on their masters whenever they can do it with impunity.

4. The Chechenzes are the most indomitable and predatory tribe of the Caucasus, and all the efforts of Russia to subdue them have hitherto been unsuccessful. The severe chastisement inflicted upon them by the Russian general Yermoloff, compelled them to remain quiet for some time, but in 1830 they again rose against the Russians and committed great ravages. In 1832 a new Russian expedition was undertaken against them, and many of their villages were burnt, and the inhabitants massacred. This severe measure spread terror among the Chechenzes, but could not prevent their occasional robberies, and the road which leads from Russia to Georgia through their country is so insecure that no travellers venture to pass it without a strong military escort. The amount of their population is very uncertain.

The *Ossetes*, who inhabit a large tract of the Caucasus, and constitute a population of about 33,000 families, are entirely distinct in language and physical constitution from the other Caucasian tribes. Klaproth thinks that they are descendants of a Median colony, settled there at a very remote epoch. A great part of this nation, occupying the southern slope of the Caucasus, was reduced to subjection by the monarchs of Georgia. They profess the Christian religion of the Greek church; and although they have preserved their own language they resemble in many respects the inhabitants of Georgia, of which their country now forms a district.

The Ossetes who inhabit the northern slope of the Caucasus have preserved their independence, although they are nominally subject to Russia. They were early converted to the Christian religion, which however they have abandoned; and, except some obscure traditions and superstitious observances, and a great veneration for the ruins of antient churches, they have scarcely any religion whatever.

The Russian government having been informed that the country of the Ossetes contained gold and silver mines, ordered (1752) a convent to be built in their country, and monks were established in order to convert the natives to the Christian religion. At the same time they sent a commission to explore the mountains, and to ascertain the existence of the mines.

The apostolical labours of the missionaries were limited to the baptism of several natives, each of whom received on that occasion twelve yards of common linen, some victuals, and a metallic cross. This reward was a sufficient inducement to many of the highlanders to be baptized, but their knowledge of the Christian religion consisted in making the sign of the cross, and in calling themselves Christians. When the expectation of gold and silver mines failed to be realized, the Russian government did not support with any great zeal the new missionary establishment, which was destroyed in 1769 by the natives, in consequence of a quarrel between a missionary priest and one of the native chiefs.

The Ossetes are a very laborious and sober nation. They are chiefly occupied in hunting and in rearing flocks, the produce of which they exchange for different objects of necessity. Besides these occupations they engage in predatory expeditions whenever a fair opportunity presents itself of doing so with impunity.

The *Abases*, or Abkhases, occupy Abasia Proper, which extends from Mingrelia along the shores of the Black Sea, a distance of nearly 70 English miles, and contains a population of about 50,000 souls, under the nomina. dominion of a prince who acknowledges the supremacy of Russia. The Abasian population is not however con-

fined to that little district. It is intermingled with the Circassians all over the country that extends along the coast of the Black Sea as far as the banks of the Kooban. Klaproth estimates their population, which is divided into ten tribes, at about 54,000 families. The ruins of many churches, which are still held in great veneration by the natives, prove that the Christian religion was once established in this country: the exercise of it however seems to have been dropped among the Abasians many centuries ago; and about seventy years back they were converted, through the instrumentality of the Turkish government, to the Mohammedan creed. Their Islamism is however very imperfect, and limited to some rites and observances prescribed by the Koran. Their country is fertile, and has many large forests, which contain excellent timber. The climate is considered healthy. The nation is divided into four classes—1st, the princes; 2nd, the nobles; 3rd, the liberated serfs; 4th, the serfs. They resemble in many respects the Circassians, and are frequently confounded with them.

The great and little Kabardahs are inhabited by Circassians who have submitted to Russians. Their population is composed of about 15,000 families.

General observations on the Caucasian Highlanders.—The general characteristics of the Caucasian highlanders, although there are differences among them in origin, language, and many other respects, are a strong love of independence united with predatory habits. Robbery is considered the most honourable occupation of a free-born man, and the greatest reproach that a Circassian girl can make to a young man is, 'You have not been able to steal even a cow.' Their education and their early habits are calculated to inure them to the hardships of a life spent in constant danger. A Circassian prince never educates his son at home, for fear of his being spoiled by the tender care of a mother. The son of a prince is entrusted to the care of some noble three days after his birth, and the father never sees him before his marriage. The boy remains all this time with his tutor, who teaches him the warlike exercises in which the Circassians excel. He undertakes with him the first warlike expeditions, and chooses for him a wife, after which the young prince returns to his family. Hospitality is a sacred duty among all these highlanders. Whenever a Caucasian has received a person into his house, he will protect him against all his enemies, even at the risk of his life. The law of retaliation is more strictly enforced among the Caucasians than among the Beduin Arabs: to avenge the death of a relation becomes a sacred obligation which descends from father to son, unless the quarrel is settled by a compensation accepted by the aggrieved party.

Although many Caucasian tribes have been converted to Mohammedanism, the most part of them may be called idolaters, as they frequently worship some inanimate objects. It is very remarkable that the prophet Elijah is a particular object of adoration among almost all the Caucasian tribes, both Mohammedan and Pagan. There are several caverns in different parts of the Caucasus consecrated to this prophet, where the inhabitants assemble on certain days to offer sacrifices to him. If a person is killed by thunder, the highlanders say that he was killed by the prophet Elijah, and consider it a great blessing for him. The burial of such a person is accompanied with the songs and dances of his relations, who rejoice in his death instead of mourning at the event. The attempts made by the Russian government to civilize the Caucasian highlanders have generally proved abortive. There are many instances of individuals belonging to those tribes, who being educated in Russia have risen to a high rank in her military service, but nevertheless have returned to their own country and abandoned European manners and customs for those of their ancestors.

GEORGIA, the most southern of the United States of North America, on the shores of the Atlantic Ocean. It extends from north to south between 30° 32′ and 35° N. lat., and from east to west between 81° and 85° 40′ W. long. Its length is 300 miles, its greatest breadth 280, and its mean breadth 203 miles. Its area is 61,000 square miles, or about 3000 square miles more than the surface of England and Wales together.

It is bounded on the east by the Atlantic. On the south it is bounded by Florida for 255 miles, the river St. Mary, constituting the boundary-line for about 80 miles; on the west lies Alabama, with a boundary-line of 306 miles. On the north lie the States of Tenessee, and of North and South Carolina. Its common boundary with the first is 80, with the second 67, and with the last 260 miles. The Savannah River separates Georgia from South Carolina, and the Chattahoochee, a branch of the Appalachicola, divides it for a considerable extent from Alabama.

The line of coast, extending 105 miles in a straight line, runs from south-south-west to north-north-east, with a slight bend westward. Though generally uniform as to course from point to point, it is very irregularly indented, and skirted by numerous islands, which are low, and in their length extend parallel to the shores. The principal of these islands from north to south are Tybee, Warsaw, Ossabow, St. Catherine's, Sapello, St. Simons, Jekyl, and Cumberland. These islands, as well as some tracts on the adjacent shore, have a light sandy soil, well adapted for the culture of cotton. The cotton grown here, known by the name of Sea-Island cotton, fetches a higher price in the market than any other. The inlets and sounds which divide the islands from one another, and penetrate several miles inland, are generally very shallow, and admit only vessels of less than 100 tons. Vessels of larger dimensions can enter only three harbours. The bar at the mouth of St. Mary's, at the most southern extremity of the State, has thirteen feet of water on it; that at the mouth of the Alatamaha, between St. Simons and Sapello, fourteen feet, and the embouchure of the Savannah seventeen feet of water; the last-mentioned river is navigable for larger vessels to the city of Savannah.

The surface of Georgia is naturally divided into two regions, a plain and a hilly country. The boundary-line between them is indicated by the falls of the rivers which occur in the Savannah, near Augusta, in the Oconee, near Milledgeville, in the Ocmulgee, near Macon, in the Flint River, at Fort Lawrence, near Knoxville, and in the Chattahoochee, near Fort Mitchell. The plain which occupies the country south of this line extends in its western prolongation through the states of Alabama and Mississippi to the banks of the river Mississippi, and continues north-eastward through the states of South and North Carolina and Virginia to Chesapeake Bay. In Georgia it is a dead flat along the shores of the ocean, with a sandy soil, which produces no trees but the pine and palmetto. In many places it is intersected with swamps, which are however less numerous and less extensive here than in the more northern states, but still occupy perhaps one-tenth of the whole tract. The largest of these swamps is the Okefinoke Swamp, near the boundary of and partly within Florida, which is about 50 miles in length and 30 in breadth. In the rainy season, when the greater part of it is covered with water, it appears like an inland sea.

This swampy tract ceases about 50 or 60 miles from the sea, except the Okefinoke Swamp, which lies farther inland. West of the swampy tract the country is dry, and the soil consists of a mixture of sand and loam; but being commonly destitute of water, it is nearly unfit for cultivation. Only along the bottoms of the rivers there occur level tracts from a quarter to half a mile wide, which, in their natural state, are covered with reeds, and have an excellent soil, well adapted to the growth of most agricultural productions, particularly rice. The higher dry grounds are mostly covered with pines.

The hilly region, which occupies nearly the northern half of the state, contains a much greater portion of arable land. The best land is along the rivers, where the soil is a deep, rich, black mould, with a small portion of sand. The gentle declivities of the hills also contain large tracts of cultivable land, and it is only their dry and sandy summits which do not admit of cultivation and are covered with pines. The productiveness of the country which till lately belonged to the Cherokees is very imperfectly known. The most southern ridges of the Appalachian mountains occur along the northern boundary-line of Georgia, but they do not appear to attain a great elevation, probably nowhere more than 1500 feet above the level of the sea.

The rivers which drain Georgia fall partly into the Gulf of Mexico and partly into the Atlantic. The former traverse either Alabama or Florida before they reach the sea. The most western is the Etowah river, a branch of the Coosa, one of the principal branches of the Alabama. The Etowah drains the country lately in possession of the Cherokees, and runs about 80 miles within Georgia. The

most important river of Georgia which falls into the Gulf of Mexico is the Appalachicola, or rather its two principal branches, the Chattahoochee and Flint rivers; for it is only at the extreme south-western angle of this state that these two rivers unite and take the name of Appalachicola. The Chattahoochee rises between the most southern spurs of the Appalachian range, about 34° 40′ N. lat. It runs in a general south-western direction through the northern part of Georgia for about 200 miles, and in approaching 33° N. lat. it begins to turn gradually to the south until it flows due south, forming for about 190 miles the boundary between Georgia on one side and Alabama and Florida on the other. It runs above 400 miles before it joins the Flint river. The Flint river rises in the western districts of the hilly region, between 33° and 34° N. lat., and flows in a southern direction as far as 32° N. lat., whence it gradually declines towards the west, until, south of 31° N. lat., it turns nearly due west, and joins the Chattahoochee. Its whole course is about 210 miles. The Ocklockonnee and Suvanee, two rivers of Florida, rise in the southern districts of Georgia, and the Ogeechee in the northern.

The most southern river that falls into the Atlantic is St. Mary's river, whose sources lie partly in Okefinoke Swamp, and partly north of it. It flows with a very tortuous channel, first south, then east, afterwards north, and again east, and enters the sea between Amelia and Cumberland islands, after a course of 110 miles. The Alatamaha runs through the central districts of Georgia; it is formed by the rivers Ocmulgee and Oconee, both of which rise towards the centre of the hilly region, near 34° N. lat., and run to the east of south for 160 miles nearly parallel to one another, at a mean distance of 40 miles. Having passed the parallel of 34°, the Ocmulgee turns east, and joins the Oconee near 30° N. lat. The river thus formed, called Alatamaha, flows first east and afterwards bends to the south-east, until it empties itself in the ocean between St. Simons and Sapello islands. Its course is about 90 miles, and the whole length of the river upwards of 280 miles. Larger vessels can only ascend this river to Darien, but boats of 30 tons are navigated up the Oconee to Milledgeville, and an equal distance up the Ocmulgee. The Savannah river rises on the most southern declivity of the Appalachian range, and runs in all its course of 250 miles south-south-east, forming in all this distance the boundary between Georgia and South Carolina. It is navigable for large vessels to the city of Savannah, and for vessels of 70 tons to Augusta.

The climate of a country extending over more than four degrees of latitude, and whose northern half is several hundred feet more elevated than its southern districts, must of course present great varieties. The hilly region is rather cold in winter. Frost is of common occurrence, and snow sometimes falls to the depth of five or six inches. But these districts are very healthy. The plain approaches in its climate the tropical regions of the globe. It is unhealthy on the bottoms of the rivers, and along the sea-coast in the vicinity of stagnant water. The heat in summer is very great, and the thermometer sometimes rises to 98° or even 102°. Its common range is between 76° and 90° in this season; but as the trade-winds on the coast of the New Continent advance in summer to 32° or 33° N. lat., they moderate the heat. Yet this season is very inconstant, and subject to storms of thunder and lightning. In winter the thermometer ranges between 60° and 40°, and sinks occasionally lower. The weather however is then dry and constant, and this is considered the most healthy and pleasant season of the year. The rains are most frequent in spring.

The great difference in the climate produces a corresponding difference in the productions. In the southern districts the temperature is suitable to the sugar-cane, orange, olive, fig, pomegranate, &c. Agriculture however is mostly limited to Indian corn, sweet potatoes, cotton, rice, tobacco, and indigo. The hilly region resembles, in climate as well as in products, the countries of Middle Europe. The greatest part of the plain is covered with several kinds of the pine, a tree which extends also over the higher portion of the hilly region. But along the sea-coast as well as on the bottoms of the rivers, oak, hickory, ash, palmetto, and some other trees, are common.

Bears and deer are very numerous in the forests and near the swamps. Alligators frequent the Alatamaha and other rivers. Honey-bees are frequent in the swamps east of Flint river. The rivers abound with several kinds of fish.

Iron and copper occur in several places in the hilly country, and the ore is said to be rich. The gold region of the Southern States passes through the country of the Cherokees. From the hills dividing the plain from the northern districts millstones are obtained, and sometimes exported to the northern States of the Union.

The whole population of Georgia is now composed of Europeans and Africans, or their descendents. Not a trace remains of the old Indian population. The Creeks, who up to 1826 inhabited the country between the Flint and Chattahoochee rivers, sold their lands in that year, and emigrated to the banks of the Arkansas. Up to 1835 the Cherokees were in possession of the north-western corner of the state, but in that year were obliged to abandon it. [CHEROKEES.] The population consisted at the last census (in 1830) of 516,520 individuals, of whom 217,470 were slaves, and little more than 2000 free blacks. This population is very unequally distributed over the surface of the country. The counties along the upper course of the Savannah, and those along the hills which divide the plain from the hilly region, are the best peopled: the greatest part of the plain, and also the north-western corner of the state, are nearly uninhabited, though the last, the country of the Cherokees, is fertile and well adapted to agriculture.

The agricultural produce of Upper Georgia is not exported, being of the same description as that of the northern states, which have the advantage of the vicinity of the sea, good harbours, and an easy internal navigation, whilst Upper Georgia is about 150 miles from its ports, which besides have not water enough for large vessels. The expense of bringing the wheat and flour to these ports is so great as to preclude the farmers from entering into competition with the northern states. Only a comparatively small quantity of tobacco and live-stock are brought down the country. The agricultural produce of Lower Georgia consists principally of cotton, rice, sugar, and indigo, all of which form articles of export. The imports into this state consist principally of manufactured goods, East India products, and wines from the southern countries of Europe. An active commerce is carried on with the northern states, which furnish butter, cheese, fish, and some other articles of less importance. Slaves are also imported from Virginia and other northern slave-holding states.

The difficulties attending the internal commerce of the state have prevented the growth of large cities. Savannah, situated about 17 miles from the mouth of the river of the same name, has a population of about 7500 souls, and carries on a very active trade in the staple articles of the country, a large part of which is shipped for Charleston. The capital of the state is Milledgeville, on the river Oconee, where it begins to be navigable for steam-boats; it has about 3500 inhabitants, and in its neighbourhood vines are cultivated with success. At Athens [ATHENS], an insignificant place north of Milledgeville, is Franklin College, an extensive institution erected in 1785, which however, up to this time, has not answered the intentions of the government. Augusta, on the Savannah river, a town of about 7000 inhabitants, carries on an active inland trade: it has also a medical college. Darien, not far from the mouth of the Alatamaha, has also some commerce, and a population of 2000. St. Mary, near the mouth of St. Mary's river, contains only 800 inhabitants.

The colony of Georgia was founded in 1732 by a private company, and received its name in honour of King George II. In 1733 General Oglethorpe founded the town of Savannah. In 1752 it became a royal government, and in 1755 a provincial legislature was established. It joined the other provinces in 1776 in declaring war against Great Britain; but in 1778 was occupied by a British force, and continued in such occupation till the peace of 1783. A new constitution was introduced in 1785, and afterwards amended in 1798. The legislative body is composed of a senate and a house of representatives. The senators, ninety in number, and the one hundred and eighty-five members of the house of representatives, are elected annually. Every free white male citizen twenty years of age and paying taxes has a vote in the election of the members of both houses. The governor, who is invested with the executive power, is chosen by the legislative body for the term of two years. The state sends two members to the senate and nine to the house of repre-

sentatives at Washington. (Darby's *View of the United States*, &c.)

GEORGICS. [VIRGIL.]

GEORGI'NA, a name sometimes given to the Dahlia, but improperly.

GEORGIUM SIDUS. [URANUS.]

GEO'RYCHUS, Illiger's name for the *Lemmings* of Cuvier. [MURIDÆ.]

GEOSAURUS, Cuvier's name for a subgenus of Saurians, found in a fossil state only, and considered by him as intermediate between the *Crocodiles* and the *Monitors*.

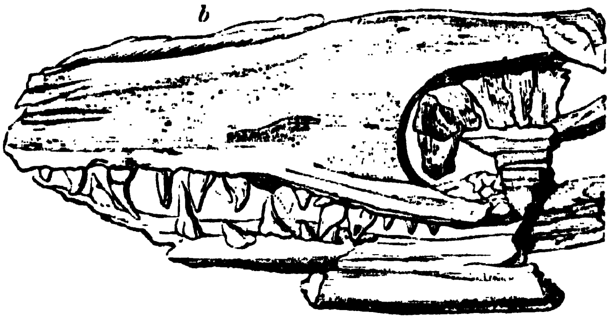
The author of a review in the 'Zoological Journal' (vol. iv. p. 255) on the 'Nova Acta physico-medica Academiæ Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum,' tom. xiii. (Bonn. 1826–7), with reference to an article therein, by Dr. Ritgen, in which the doctor proposes the restoration of the pelves of three species of animals from the fossil fragments of their skeletons, has this passage: 'The first of them is the *Lacerta gigantea* of Soemmering, *Mosasaurus* of Conybeare and Parkinson, for which Dr. Ritgen, without assigning a single reason for the change of name, is pleased to adopt the more than sesquipedalian title of *Halilimnosaurus crocodiloides*. This appellation however may serve, in some degree, to explain his views of its affinities and original habitation, inasmuch as it shows that he regards it as a lacertine animal resembling a crocodile and inhabiting salt-water marshes, intermediate therefore between the extinct *Enaliosauri*, or sea-lizards, and the living crocodiles of fresh-water streams. It is, moreover, the *Geosaurus* of Cuvier's "Ossemens Fossiles." There is some little obscurity here, which we will endeavour to dispel. That Cuvier's name, *Geosaurus*, should be retained according to the laws of nomenclature, there can be no doubt; and it appears that this provisional name was given, not in reference to the habits of the extinct lizard, but, to use Cuvier's own words, ("par allusion à Terre, mère des Géans")—by an allusion to Terra, the Earth—Ge (Γῆ) of the Greeks, the fabled mother of the Giants. Indeed the sclerotic plates still remaining in the portion of the cranium figured by Cuvier in his "Ossemens Fossiles," could not have escaped the observation of that acute zoologist (who was so eminently alive to the laws of co-existence), as indicating aquatic habits. That he considered it subgenerically different from *Mosasaurus* appears from the following observations: Immediately after the allusion to the origin of the name, Cuvier says, "I cannot retain for it the epithet *giganteus* (Je ne peux lui laisser l'épithète gantesque); for, in the great genus *Lacerta* we have already the animal of Maestricht, or *Mosasaurus*, which greatly surpassed it, and there is also another (the *Megalosaurus*) which is very superior in size—(nous avons d'abord l'animal de Maestricht, ou *Mosasaurus*, que le surpasse de beaucoup, et nous allons en voir un autre (le *Mégalosaurus*), qui lui est aussi très supérieur)."'

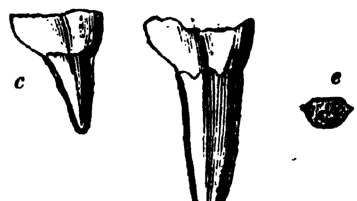
Again, in a note to the previous article in the 'Ossemens Fossiles,' on *Mosasaurus*:—'With regard to the fossil animal of Monheim ('*Geosaurus*'), which M. de Soemmering has also regarded as identical with that of Maestricht (*Mosasaurus*), we shall see in a succeeding article that it differs from the Maestricht animal in many respects.' M. Hermann von Meyer, in his most useful work, 'Palæologica zur Geschichte der Erde und ihrer Geschöpfe,' (8vo. Frankfort, 1832), widely separates the two subgenera. The first, *Geosaurus*, he exemplifies by *Geosaurus Sömmerringii*, syn. *Lacerta gigantea*, Sömmering, *Halilimnosaurus crocodiloides* of Ritgen. The second, *Mosasaurus*, Conybeare, *Saurochampsa*, Wagler, he exemplifies by *Mosasaurus Camperi*, syn. *M. Hofmanni*, *Lacerta gigantea*, Sömmering, zum Theil (in part). In his 'System der Fossilen Saurier,' which fossil Saurians he divides into four sections, denoted by the letters A, B, C, and D, he places *Geosaurus* under section A—(Saurier mit zehen, ähnlich denen an den lebenden Sauriern*), and *Mosasaurus* under section C—(Saurier mit flossartigen Gliedmassen†).

The remains upon which Cuvier founded his subgenus were found in the canton Meulenhardt, at the depth of ten feet, and a few paces from the crocodile described by Cuvier (Gavial of Monheim and of Boll; 'Oss. Foss.' tom. v. pp. 120–125: *Crocodilus priscus* of Sömmering; *Æolodon priscus* of Hermann von Meyer), by the labourers employed to work the mines of granular iron (fer en grains) which fills the fissures of the strata of calcareous schist.

a

b



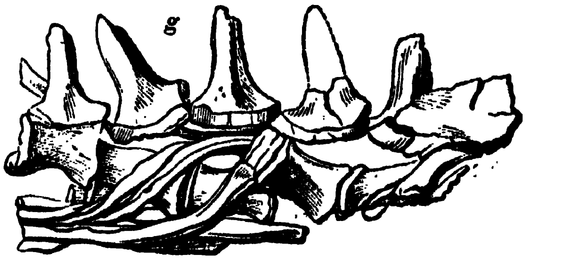


c d e

f

* Saurians with toes similar to those of existing Saurians, and either four-toed or five-toed. Geosaurus is placed in the four-toed group, with an indication of doubt, in consequence of the want of sufficient materials.

† Saurians with fin-like extremities, under which Mosasaurus is classed without any expression of doubt



Geosaurus Sömmeringii, from Cuvier's figures: *a, b*, part of the head, which has been compressed; some of the sclerotic plates are still left within the orbit, as seen in fig. *b*; *c, d, e*, teeth which had preserved their hard shining brown enamel; *f, g*, vertebræ;—*f* exhibits a part of the column; near the last vertebræ are the remains of the pelvis and femora; *g*, five vertebræ like the first of those in figure *f*. Fragments of ribs in disorder are seen near both sets.

Sömmering, to whom the Count of Reysach gave those *precious fragments*, to use Cuvier's expression (for, in consequence of the nature of the bed in which they were discovered they were not well preserved), published an accurate account of them in the 'Memoirs of Munich' for 1816, accompanied by a lithographic illustration, which Cuvier reduced, and published in his 'Ossemens Fossiles;' Sömmering however thought that the bones belonged to a young individual of the Maestricht animal (Mosasaurus).

The bones were nearly calcined. Near the remains of the Saurian were a flat ammonite four inches in width, a fragment of bluish shell, and a great quantity of small scales, which, according to Sömmering's conjecture, belonged either to fishes or perhaps to the animal itself, if it was a Monitor, or some other lizard with small scales.

Our limits will not allow us to point out the differences between *Geosaurus* and *Mosasaurus*, excepting that they are to be found principally in the teeth and in the vertebræ. The reader who wishes to pursue the inquiry further has only to consult the works above referred to, for the details which have led to the conclusion that the animals are different. The localities given by Hermann von Meyer are the Flötz; Solenhofen slate (Schiefer von Solenhofen); and, with reference to another specimen (with a query), for which he refers to Dekay, 'Ann. of the Lyc. of New-York,' vol. iii., the marl of the green sand in New Jersey (Mergel des Grünsandes in New Jersey).

GERA, the chief town of the three principalities of Reuss-Schleiz, Reuss-Greiz, and Reuss-Lobenstein and Ebersdorf, which are on the western borders of the kingdom of Saxony, is in 50° 52′ N. lat. and 12° 6′ E long. The present town is mostly of modern construction, the old town having been almost entirely destroyed by fire in September, 1780. It is agreeably situated in a valley on the banks of the White Elster, and contains about 860 houses and 9200 inhabitants. The streets are in general broad and at right angles to one another, and embellished with a number of handsome houses. Gera is the seat of government for the Reuss principalities, and of a Protestant consistory. It has a fine town-hall; five churches, independently of the high church of St. John, which is in ruins; a highly esteemed gymnasium attended by between 600 and 700 pupils, who are separated into five classes for such as are intended for a learned or scientific profession, and six for those designed for commercial pursuits, &c.; a seminary for scholars of the higher ranks of society; a school for educating teachers; a house of correction, to which an orphan asylum is attached; two hospitals; a free school, and other scholastic establishments. Gera, from the enterprise and industry of its inhabitants, has been called 'Little Leipzig.' It possesses numerous manufactures, particularly of fine woollens, mixed cotton and silk goods, woollen and cotton yarns, china, earthenware, printed cottons and woollens, oil-cloth, tobacco, carriages, chemical colours, hats, leather, musical instruments, soap, beer, &c. A canal has been made from the Elster, which passes through the town, and is of great use to the manufacturers. The position of Gera secures to it a considerable transit trade with the adjacent countries. The Gera china is made at Schloss Untermhaus, which, together with the princely residences of Osterstein, Köstritz, and Ronneburg, are in the vicinity of the town.

GERA'CE. [CALABRIA.]

GERANIA'CEÆ, a natural order of Exogens, the distinguishing character of which is to have a fruit composed of five cocci or cases, connected with as many thin flat styles, consolidated round a long conical beak, and from which they are separated with violence at the time of maturity by the rolling back of the styles. In many respects they are allied to Malvaceæ, especially in the arrangement of their petals, the tendency to union among the stamens, and in their stipules. It is probable that Tropæolum, although usually looked upon as the type of a distinct order, is only a variation from the typical character of Geraniaceæ. These plants are usually astringent and odoriferous; their smell varying from a disagreeable hircine character to that of great sweetness. The maximum of the order occurs at the Cape of Good Hope under the form of the genus Pelargonium, hundreds of beautiful varieties of which are now favourite objects of cultivation in gardens: these are chiefly bushes. Those species of the order which inhabit Europe are herbaceous plants, with regular flowers and five or ten perfect stamens; a few are handsome enough to be cultivated, but the major part consists of mere weeds. The flowers of the whole order are usually of some tint of purple; it is therefore remarkable that a few species should exist in which the colour is a pure bright yellow; as in Geranium chrysanthum, a native of the South of Europe.

Geranium pratense.
1, a magnified calyx, in the centre of which is the rostrum, or beak, from which the cocci are rolling back.

GERARD, a celebrated translator of the middle ages, was born at Cremona, in Lombardy, in 1114. He early applied himself to philosophical studies, but as they were in a very low condition at that time amongst the Western Christians, he went to Spain, where learning was in a flourishing state amongst the Arabs. He there became thoroughly acquainted with the Arabic, and applied himself particularly to the translation of different works from that language into Latin. Gerard returned to his native town, where he died in 1187, at the age of 73.

His principal translations which have reached us are: 1. *Theoria Planetarum*. 2. 'Allaken de Causis Crepusculorum.' 3. 'Geomantia Astronomica,' which was translated into French, and published under the title of *Géomantie Astronomique*, in 1669 and 1682. 4. The Treatise on Medicine, of Avicenna, known by the name of the 'Canons.' 5. An Abridgment of the Medical Treatise of Rhazis, made by Abouli Ben David. 6. A Treatise on Medicine, by the same Rhazis. 7. 'Practica sive Breviarium Medicum' of Serapion. 8. The Book of Albenguefit 'De Virtute Medicinarum et Ciborum.' 9. The 'Therapeutica' of Serapion. 10. The work of Ishak, 'De Definitionibus.' 11. 'Albucasis Methodus Medendi,' (libri iii.). 12. 'Ars Parva' of Galen. 13. 'Commentaries on the Prognostics of Hippocrates.' All these works have been often printed.

GERARDE, JOHN, a famous herbalist of the time of Queen Elizabeth, was born at Nantwich in Cheshire, in the year 1545, and was educated as a surgeon. He removed to London, where he obtained the patronage of Lord Burghley, who was himself a lover of plants, and had the best collection in his garden of any nobleman in the kingdom. Gerarde had the superintendence of this fine garden,

and retained his employment, as he tells us himself, for twenty years.

His London residence was in Holborn, where also he had a large physic garden of his own, which was probably the first of its kind in England for the number and variety of its productions. It should seem that in his younger days he had taken a voyage into the Baltic, since he mentions having seen the wild pines growing about Narva. He also says of the bay or laurel tree (*Herbal*, pp. 1177, 1223), 'I have not seen any one tree thereof growing in Denmark, Suecia, Poland, Livonia, or Russia, or in any of those wild countries where I have travelled.'

Among the Lansdowne manuscripts in the British Museum (No. cvii., art. 92) is a letter of Gerarde's own drawing up for Lord Burghley to send to the University of Cambridge, recommending the establishment of a physic garden there, to encourage 'the facultie of simpling;' Gerarde himself, whom Lord Burghley calls his servant, to be placed at the head of it: 'So that if you intend a work of such emolument to yourselves and all young students, I shall be glad to have nominated and furnished you with so expert an herbalist; and youselves, I trust, will think well of the motion and the man.' As we read no more of it, it is probable that the scheme did not take effect.

The earliest publication of Gerarde was the catalogue of his own garden in Holborn: 'Catalogus Arborum, Fruticum, ac Plantarum, tam indigenarum quam exoticarum, in horto Johannis Gerardi, civis et chirurgi Londinensis, nascentium,' impensis J. Norton, 1596, 4to.; reprinted in 4to. 1599. The first edition was dedicated to Lord Burghley; the second, after that nobleman's death, in very flattering terms, to Sir Walter Raleigh. A copy of the first edition (of extreme rarity) is preserved in the library of the British Museum, where it proved of great use to Mr. Aiton in preparing his 'Hortus Kewensis,' by enabling him to ascertain the time when many old plants were first cultivated.

In 1597 came out his 'Herbal, or General History of Plants,' printed by John Norton, in folio. The wood-cuts with which it was embellished were procured from Francfort, being the same blocks which had been used for the 'Kreuterbuch,' the German herbal of Tabernæmontanus, fol. Franc. on the Mayn, 1588. A second edition of Gerarde's 'Herbal' was published by Dr. Thomas Johnson, with emendations and corrections, fol. Lond. 1633; and this work continued to be one of the best sources of botanical intelligence, at least to the beginning of the eighteenth century

Gerarde died about the year 1607.

(Pulteney's *Sketches of the Progress of Botany in England*, vol. i., p. 110-125; Chalmers's *Biogr. Dict.*, vol. xv., p. 414.)

GERBERT, MARTIN, Prince-Abbot of St. Blaise, near Freiburg, a learned and laborious writer on music, was born at Horb-sur-le-Necker, in 1722. Attached from his youth to church-music, he cultivated it assiduously, and having determined to write a history of that highly important branch of the art, which he thought intimately connected with his sacred profession, he travelled during three years in France, Italy, and various parts of Germany, for the purpose of collecting materials in aid of his work, which was published in two quarto volumes, in 1774, and entitled *De Cantu et Musica Sacra, à prima Ecclesiæ Ætate usque ad præsens Tempus*. He divides his history into three parts. The first finishes with the pontificate of St. Gregory; the second reaches the 15th century; and the third comes down to nearly the date of his own volumes. Though the illustrious Abbot directed his attention almost wholly to the music of the Catholic church, that is, to the Mass, he liberally notices that of the Protestant establishments, and mentions in favourable terms Dr. Boyce's collection; but being one of those who disapprove the use of fugue, and all such laboured compositions, in ecclesiastical music, he censures the style while he admits the genius and skill of the English composers for the church. Gerbert published in 1784 another work, of equal importance with the former, in two volumes, under the title of *Scriptores Ecclesiastici de Musica Sacra Potissimum*, &c., which is a collection of authors who have written on the subject of his favourite pursuit, from the third century to the invention of printing. These, in number upwards of forty, are arranged chronologically. The work is extremely rare, but M. Forkel has given a useful analysis of it in his History of Music. Gerbert died in 1792. (Schlichtegroll's *Necrology*, vol. ii.)

GERBERT, afterwards pope Sylvester II., was born of poor parents at Aurillac in Auvergne. The time of his birth does not appear to be known; he died in 1003, at a very advanced age.

When young he entered the monastery of St. Gerauld at Aurillac, and in that school commenced his studies. He afterwards visited Catalonia, where he learned mathematics from a Spanish bishop. About 968 he made a journey to Rome, a circumstance which gave him the opportunity of still further satisfying his thirst for knowledge. When Otho I. conferred on him the abbey of Bobbio, Gerbert's industry was not diminished by his promotion. He employed himself actively in teaching, and for several years, while he continued to reside at Bobbio, his fame attracted students from all quarters. Though he kept his abbey till his elevation to the pontifical chair, he gave up his residence in Italy on account of the uneasy life which he led there. From Italy he is said to have gone to Germany, where he became the tutor of young Otho, afterwards the second emperor of that name. From Germany he went to Reims, and was made secretary to the archbishop of Reims, and master of the cathedral-school. It is as a teacher that Gerbert established a reputation which few men since his time have acquired. Under his care the school of Reims became one of the first in Europe, and its high character was maintained for near a century after his death. Among Gerbert's pupils we find the names of Nithard and Remi. In A.D. 992 Gerbert was promoted to the archbishopric of Reims, from which however he was deposed a few years after his elevation. In 998 he received the archbishopric of Ravenna from the emperor Otho III.; and in 999 he was elected to the pontifical chair, which he filled for nearly five years, under the name of Sylvester II.

There is no doubt that Gerbert was a man of great ability and of very extensive acquirements for his age. He was also a most voluminous writer. The Benedictines of St. Maur (*Histoire Littéraire de la France*, tom vi., 577, &c.) have devoted many pages to the consideration of his writings; but they have shown no great discrimination in their criticism. Geometry and astronomy were Gerbert's favourite pursuits; there is or was extant a MS. treatise of his on sun-dials, and he also wrote on the astrolabe. He is said to have been acquainted with the Greek language. His letters, printed by Du Chesne, 1636, at the end of the second volume of his 'Historians of France,' throw some light on the ecclesiastical intrigues and political events of the time.

GERBILLUS. [JERBOA.]

GERFALCON. [FALCONIDÆ; FALCONRY.]

GERMAIN, ST., a town in France in the department of Seine et Oise, distinguished from a multitude of other places of the same name by the epithet *en Laye*. It is on the left bank of the Seine, 14 or 15 miles from Paris on the road to Evreux and Caen. The town had its origin from a monastery founded by King Robert (who reigned A.D. 996—1031), dedicated to St. Germain and St. Martin. There was a royal residence here from a very early period, but the present palace, the chief edifice in the town, was commenced by Francis I. and enlarged by Louis XIV. The town is of considerable extent, containing in 1831 a population of 10,671. It is agreeably situated on a height which commands a beautiful prospect of the valley and the sinuous course of the Seine, with a distant view of St. Denis, Paris, and its environs. The streets are handsome and well laid out, and the houses lofty and well built: there are many antient mansions, once the residence of the lords of the court, before Louis XIV. forsook this place for Versailles. The château, or palace, is a heavy building, chiefly of brick, surrounded by wide and deep ditches; the apartments are handsome. The château was used under Louis XVIII. and Charles X. as a barrack for a company of the Gardes du Corps. The Château Neuf, built by Henri IV. for his mistress 'La Belle Gabrielle,' is now a heap of ruins. The forest or park of St. Germain, surrounded by walls and occupying more than 10,500 acres, is adorned by trees of immense size, and has numerous broad avenues. The royal family resort hither to hunt the deer and other game, of which there is a considerable quantity. A noble terrace, of more than a mile and a quarter in length and nearly 100 feet wide, extends from the palace along the skirts of the forest, and affords to the towns-people an agreeable promenade. In the forest are several small edifices erected at different periods by the kings of France. The town has a

church of modern erection, a new corn-market, and a theatre. It is the residence of a Juge de Paix. The manufactures are of little account; they are of stockings and leather. A yearly fair is held for business; and one a few days afterwards for pleasure: the latter is held in the forest, and attracts a number of visitors from Paris and the surrounding villages. There are many schools; and in the neighbourhood is a subsidiary school for the education of 200 orphan daughters of the members of the Legion of Honour. There are a small public library and an hospital for the sick and aged.

Henri II., Charles IX., and Louis XIV. were born at St. Germain; and Louis XIII. died there. James II. of England and his family found in exile an asylum there. James died at St. Germain in 1701, and his remains were discovered in 1826 in digging the foundations of the new church.

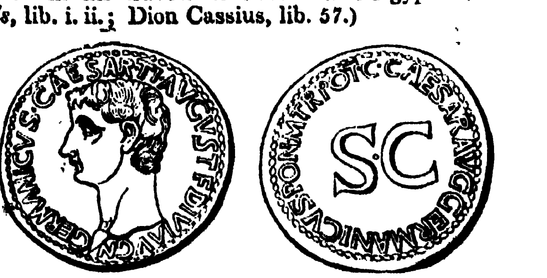
GERMAN'S, ST. [Cornwall.]

GERMAN-BANATE, a considerable district of Southern Hungary, forming, with the Illyrian-Walachian district, the province called the 'Banate, or Hungarian Frontier.' It is the most westerly part of it, lies next the Danube in the south and west, and has the Hungarian counties of Torontal and Temesch for its northern and eastern boundaries. The area is about 1581 square miles; it has one town and sixty villages and hamlets; and its population, which, by the conscription lists, was 61,988 in 1799, and 85,635 in 1815, is now about 116,000, the majority of whom are of the Greek faith. The surface is a complete level, in the centre of which is the great sandy plain of Bieloberdo. It is watered by the Themes, Nera, &c., has extensive swamps, and produces much grain, as well as hemp, vegetables, wine, &c. The woods cover an area of about 11,970 acres. Considerable numbers of horses, oxen, sheep, and swine, are reared. There is only one town in the Banate, Pancsova, at the confluence of the Themes and Danube, in 44° 49′ N. lat., and 20° 38′ E. long.: it is a fortified place and a free town, with extensive lands lying around it, which belong to the municipality. Its population was 6765 in 1806, and it now amounts to nearly 9000: it has two churches, a gymnasium, a mathematical and a normal school, several other schools of an inferior class, and about 950 houses. It is the head-quarters of the Austrian German-Banate regiment, and has a brisk trade with Turkey.

GERMAN OCEAN. [North Sea.]

GERMA'NICUS, CÆSAR, the eldest son of Drusus Nero Germanicus and of Antonia the younger, the nephew of Tiberius, and brother of Claudius, afterwards emperor, was born in the year 14 B.C. Augustus on adopting Tiberius made the latter adopt his nephew Germanicus. At the age of twenty Germanicus served with distinction in Dalmatia, and afterwards in Pannonia, and on his return obtained a triumph. He married Agrippina the elder, grand-daughter of Augustus, by whom he had nine children; among others Caius Caligula, and Agrippina the younger, mother of Nero. In A.D. 12 Germanicus was made consul, and soon after he was sent by Augustus to command the legions on the Rhine. On the news of the death of Augustus some of the legions on the lower Rhine mutinied, while Germanicus was absent collecting the revenue in Gaul; he hastened back to the camp, and found it a scene of tumult and confusion. The young soldiers demanded an increase of pay, the veterans their discharge. They had already driven the centurions out of the camp. Some offered their assistance to raise Germanicus to the supreme power, but he rejected their offers with horror, and left his judgment-seat, heedless of the clamours and threats of the mutineers. Having retired with a few friends to his tent, after some consultation on the danger to the empire, if the hostile Germans should take advantage of the confusion caused by this sedition of the troops, he determined upon exhibiting to the soldiers fictitious letters of Tiberius, which granted most of their demands, and the better to appease them he disbursed to them immediately a considerable sum by way of bounty. He found still greater difficulty in quelling a second mutiny, which broke out on the arrival of legates from the senate, who brought to Germanicus his promotion to the rank of Proconsul. The soldiers suspecting that they came with orders for their punishment, the camp became again a scene of confusion. Germanicus ordered his wife Agrippina, with her son Caius Caligula, attended by other officers' wives and children, to leave the camp, as being no longer a place of safety for them. This sight affected and mortified the soldiers, who begged their commander to revoke the order, to punish the guilty, and to march against the enemy. They then began to inflict summary execution on the ringleaders of the mutiny, without waiting for the order of their commander. A similar scene took place in the camp of two other legions, which were stationed in another part of the country under the orders of Cæcina. Availing himself of the present state of excitement of the soldiers, Germanicus crossed the Rhine, attacked the Marsi, the Bructeri, and other German tribes, and routed them with great slaughter. In the following year, taking advantage of a quarrel between Arminius, the conqueror of Varus, and Segestes, another German chief, he attacked Arminius, and penetrated to the spot where the legions of Varus had been cut to pieces. The bones of the Roman soldiers, which still lay on the ground, were collected and buried by their countrymen. Arminius however fought bravely, and was near defeating a division commanded by Cæcina. In the following campaign Germanicus embarked his troops on board a flotilla which he had constructed or collected for the purpose, and sailing from the island of the Batavi, he landed at the mouth of the Ems, from whence he marched towards the Visurgis, or Weser, where he found Arminius encamped. Two obstinate battles were fought in succession, in both of which Arminius was defeated. Germanicus raised a trophy with this inscription: 'The army of Tiberius Cæsar, having conquered the nations between the Rhine and the Elbe, consecrates this monument to Mars, Jupiter, and Augustus.' After this victory he sent part of his legions by land to their winter-quarters on the Rhine, and with the rest embarked on the Ems, to return by sea; but being surprised by a dreadful storm, his vessels were dispersed, many were lost, and he himself was cast on the coast of the Chauci, whence he returned to the Rhine and placed the legions in winter-quarters. Meantime Tiberius wrote repeatedly to his nephew, that he had earned enough of glory in Germany, and that he ought to return to Rome to enjoy the triumph which he had merited. Germanicus asked for another year to complete the subjugation of Germany, but Tiberius, who felt jealous of the glory of his nephew and of his popularity with the troops, remained inflexible, and Germanicus was obliged to return to Rome, where he triumphed in the following year, A.D. 17. The year after, he was consul for the second time with Tiberius himself, and was sent to the East, where serious disturbances had broken out, with most extensive powers. But Tiberius took care to have a watch over him by placing in the government of Syria Cnæus Piso, a violent and ambitious man, who seems to have been well qualified for his mission, as he annoyed Germanicus in every possible way, and his wife Plancina seconded him in his purpose. The frank and open nature of Germanicus was not a match for the wily intrigues of his enemies. After making peace with Artabanus, king of the Parthians, and calming other disturbances in the East, Germanicus fell ill at Antioch, and after lingering some time he died, plainly expressing to his wife and friends around him his conviction that he was the victim of the treason of Piso and Plancina; whether he meant through poison, or through their annoyances, has been a subject of doubt. His wife Agrippina, with her son Caius and her other children, returned to Rome with the ashes of her husband. [Agrippina the Elder.]

Germanicus was generally and deeply regretted. Like his father Drusus he was while living an object of hope to the Romans. He died A.D. 19, in the 34th year of his age. He is praised for his sincerity, his kind nature, his disinterestedness, and his love of information, which he exhibited in his travels in Greece and Egypt. (Tacitus, *Annals*, lib. i. ii.; Dion Cassius, lib. 57.)



Coin of Germanicus.

British Museum. Actual size. Copper. Weight, 171 grains.

GERMANY extends from 45° 5′ to 57° 50′ N. lat. and

from 6° 20′ to 20° 10′ E. long. It is bounded on the west by the Netherlands, Belgium, and France; on the south, by Switzerland and the Austrian territories in Italy; on the east, by the kingdoms of Hungary, Gallicia, Poland, and Prussia; and on the north, by the Baltic. Its area is stated to be 284,000 square miles, or about twice and a half the area of the British islands.

The surface is divided into four distinctly marked districts, two plains and two mountain-regions. One of the plains is low, and rises only a little above the level of the sea; the other attains a considerable elevation. Between the two plains extends a mountain-region, whose summits in no part attain the snow-line, which in this parallel is calculated to be about 6000 feet above the sea-level. To the north of this region extends the low plain, and to the south of it the elevated plain, which on the east and west is enclosed by mountainous tracts belonging to that region. The southern boundary of the elevated plain is formed by the Alps, which constitute the fourth natural division of Germany.

The *low plain* is only a small section of the great plain which extends nearly over the whole northern part of the old continent. This section occupies the northern portion of Germany, which lies on the southern shores of the North and Baltic Seas, and extends to the peninsula of Jutland. Its length, from the boundary of the Netherlands and the Rhine to the borders of Russia, including the kingdom of Prussia, is nearly 600 miles; but its width varies, being, on the west of the Elbe, on an average about 160, and to the east of that river about 300 miles. The line which separates it from the mountain-region south of it may be determined in the following way:—Beginning on the west with the bank of the Rhine, it follows the course of the river Lippe (51° 40′ N. lat.) as far as the town of Paderborn, and thence follows a line drawn from that town in a north-eastern direction to Hanover, and so on through Brunswick to Magdeburg on the Elbe. From Magdeburg it runs nearly south to Halle on the Saale, and thence south of Leipzig to Dresden. From the capital of Saxony it extends due east to Breslau on the Oder, from which town it follows the course of this river nearly to its source, and to the Carpathian mountains, which constitute its southern boundary farther eastward.

There is probably no tract of country in Europe of equal extent which has a less fertile soil than this plain. Even the steppes of Southern Russia to the north of the Black Sea have a better soil, but as they have not the advantage of abundant rains, which are enjoyed by the German plain, the latter is much better cultivated and more thickly inhabited than the Russian steppes. This plain is supposed to have been once covered by the sea. Its substratum is formed by limestone, chalk, gypsum, and sandstone, which are covered by loam, clay, and sand, to an average depth of 200 feet. If this country were situated under a tropical climate and deprived of the abundant rains and snow which annually descend upon it, the surface would resemble the Sahara or the great Indian plain.

Though sterility is the general character of this plain, still there is a remarkable difference between the countries west and east of the Elbe river. On the west of that river the plain is nearly destitute of trees. It presents a succession of tracts covered with heath and juniper bushes, and of moors which mostly consist of turf, a hundred feet deep and upwards. Each of these tracts occupies an extent of 12 or 15 miles square, and the succession is sometimes interrupted by tracts entirely covered with sand and nearly without vegetation. A sandy tract of this description, which has been particularly described by the German geographers, is called the Huimling. It extends along the eastern banks of the river Ems, between the mouths of the rivers Hase and Leda, is at a considerable elevation above the surrounding country, and at its base is nearly 24 miles in circumference. All over this plain cultivable ground occurs only in the shape of oases which are at great distances from one another. The soil produces on an average only three or at the utmost four times its seed. To complete the picture of this plain, we shall add a description of those districts which are distinguished by fertility. The rivers run in depressions from 100 to 200 feet below the level of the plain. Along their banks there are bottoms with a fertile soil, which are covered in their natural state by forest trees, and when cultivated produce good crops. These bottoms vary in width, according to the volume of water in the rivers. Along the great rivers (Weser, Elbe), they are from three to six miles wide, where these rivers issue from the mountain tracts in which they originate; but farther down they widen to twenty or thirty miles and even more. Where the rivers approach the sea, the bottoms are united with the marshes which line the shores of the North Sea these marshes are not of great extent, being only five or six miles across on the average, but they do not yield in fertility to any tracts in Europe. Being below the level of the sea at high tides, it is necessary to protect them by dikes from its invasions. Nearly in the middle of the plain occurs another fertile tract, enclosed by two ridges of high hills, which issue from the mountain-tract farther south, on both sides of the parallel of 52° N. lat. The more northern of these ridges, called the Süntel, rises to the south of the town of Hanover, whence it runs westward, and south of Minden forms the Porta Westphalica, where it is broken through by the river Weser. To the west of this river it continues westward, and terminates about six miles from the river Ems. This ridge hardly reaches an elevation of 1000 feet above the sea. The southern ridge has the name of Egge east of Paderborn, and runs there south and north, but north-east of that town it turns west-north-west, and continues in that direction, approaching gradually the Süntel Hills, which however it does not join, as it terminates about three miles from the Ems, opposite Schüttorf, and about the same distance from the western extremity of the Süntel Hills. This ridge is known by the name of the Teutoburger Wald, or Osning. The valley between these two ridges is of considerable fertility; its eastern portion forms the principality of Lippe Detmold, and its western belongs to the Prussian province of Westphalia and the Hanoverian province of Osnabrück. That portion of the plain which is situated to the south of this valley contains a much larger portion of arable land than that which is north of it. The country between the Weser and Elbe does not differ in its general character from that west of the Weser in its northern districts, but towards the south it partakes more of the peculiar nature of the eastern portion of the plain, being mostly covered with forest trees of the pine kind. Such is the heath of Lüneburg, which occupies the whole space between that town and Hanover.

That portion of the plain which lies east of the Elbe has a somewhat different character. Tracts covered with heath and moor occur here also, not contiguous, but separated from each other by great intervals of sandy surface. These sandy tracts however are not destitute of vegetation, nearly all of them being covered by various kinds of pine, which give the soil a greater degree of solidity. Still all lands of this description are only cultivated in a comparatively few and favoured places, and the crops are very scanty; but this portion of the plain contains a greater number of fertile tracts, which in some places are of considerable extent. The bed of the rivers is less depressed below the level of the plain, and the rich lands along their banks have a greater width. The marshes which are adjacent to such lands, and nearly on the same level with them, have been drained, and changed into meadows and fields. Along the shores of the Baltic no marshes occur, but the larger rivers, especially the Vistula and Niemen, form deltas at their mouths, whose alluvial soil is of great fertility, and can hardly be exhausted by successive crops. Besides these there are several fertile tracts at some distance from the rivers, whose soil is a heavy loam of considerable fertility. Such lands are more common between the Elbe and Oder than between the last-named river and the Vistula, and still more so between this river and the Niemen.

Through the northern part of this plain a higher tract may be traced, which in general runs west and east, but with two great bends. It begins on the west at Oldeslo in Holstein, whence it runs east-south-east nearly in a straight line to Schwedt on the Oder, where it is about seventy miles from the sea. East of that river it continues due east to Arendswalde, and then inclines to the north, gradually approaching the sea. Some distance west of Danzig it takes a short south-east course, and then again due east, terminating on the banks of the Niemen, near Grodno. This tract of high ground forms the watershed between a great number of small rivers which fall into the Baltic and many others, with a much longer course, which run off to the southward, and increase the waters of the Elbe, Oder, and Vistula. It is also remarkable for the immense number of small lakes which occur on its higher parts or near them. Some of these are lakes of considerable extent, as the lake

of Schwerin, near the western extremity, and the lake of Spirding, towards the banks of the Niemen. On the northern side of this high ground we find those numerous erratic blocks or boulders which have attracted the attention of geologists.

The *mountain region of Central Germany* extends to the south of the low plain, and encloses the elevated plain on the east, north, and west. That portion of it which is to the east of the elevated plain may be called the mountain-system of Bohemia, because it encloses that kingdom on all sides. That which extends to the north of the elevated plain we shall call the Central mountain-system of Germany; and the ranges enclosing the elevated plain on the west, the Rhenish mountain-system, because they run parallel to the middle course of the Rhine.

The Fichtelgebirge and the Forest of Bohemia, of which an account is given under those respective articles, form the western branches of the mountain-system of Bohemia. At the south-eastern extremity of the Forest of Bohemia, the mountain-range turns first to the east and afterwards to the north-east, in which direction it continues until it reaches 50° N. lat., where it meets another and higher range, extending in a different direction, from south-east to north-west. The last-mentioned range is the Sudetes, or Sudetsch mountains, and the former the Moravian mountains. The Moravian mountains, which extend about 160 miles in length, and form the watershed between the Danube and Elbe, are of very moderate elevation; hardly any part of them exceeds 3000 feet, and as the basis on which they stand can hardly be less than 2000 feet above the sea-level, they have not the appearance of mountains. Their higher parts also extend in plains, and their declivities sink with a gradual descent, so that the country (Moravia) which is covered by the south-eastern offsets is more like a plain with a strongly undulating surface, than a mountain-region. Several of the offsets to the north-west (into Bohemia) are of great elevation.

The Sudetes or Sudetsch mountains begin about seventy miles south-east of the point where they are joined by the Moravian mountains, at the sources of the river Oder. They are not connected with the Carpathian mountains, but separated from that system by a wide elevated valley, in which the river Oder flows. The southern portion resembles in height and formation the Moravian mountains, and both are covered with extensive forests. Where both ranges join, the Sudetes begin to rise higher; and the Glatzer, or Grulicher Schneeberg, attains an elevation of about 4780 feet. Farther to the north-west the range rises still higher, and is known by the name of the Riesengebirge, or Giant Mountains. The Grosse Rad (Great Wheel) rises to 4950, the Schneekappe (the Snow-cap) to 5320, and the Sturmhaube to 4800 feet above the sea. This range, which, from the sources of the Oder to those of the river Neisse in Lusatia, extends upwards of 130 miles, and whose average width is about 35 miles, consists of granite, gneiss, mica-slate, sandstone, porphyry, and limestone. Its higher parts are formed of immense rocks, broken down in all directions, and split by deep rents; they are mostly bare. Pine-forests occur in some tracts, and others are used as pasture-ground; but in most parts the vegetation is limited to a few mosses. The more gentle declivity towards Bohemia is better wooded, and has better pastures than the steeper descent towards Silesia. Snow lies on the summits of these mountains from October to June.

From the sources of the river Neisse in Lusatia the range turns suddenly to the west, and is accordingly with some reason considered as a separate range, though sometimes it is viewed as a portion of the Sudetes. It is called the Mountains of Lusatia, or the Wolish Kamm. Its eastern portion, which has a considerable elevation, contains the Hochwald, which rises to 2500 feet; and the Laushe or Spitzberg, which attains 2624 feet. Its highest parts extend in plains, intersected by narrow and steep valleys. The western portion near the Elbe does not rise to any great height, and is often interrupted by wide valleys, so as not to form a continuous ridge. On account of its natural beauties, it is called the Saxon Switzerland (Sächsische Schweitz). The most western mountain is the Lilienstein, 1312 feet above the sea; it rises with a steep declivity from the very bed of the Elbe. On the other side of the Elbe, and opposite the Lilienstein, begins that range which is called the Erzgebirge (Ore Mountains), and which extends to the Fichtelgebirge. [ERZGEBIRGE.]

The Fichtelgebirge and the Erzgebirge are the last ranges that belong to the mountain-system of Bohemia; the mountainous countries to the north-west of them are parts of the Central mountain-system of Germany. This system extends to the very banks of the Rhine. Its average breadth rather exceeds 100 miles; but the whole region does not extend in the same direction. The eastern portion lies south-east and north-west, and the western, south-west and north-east, so that they meet nearly at a right angle, about 50° 30′ N. lat., and 11° E. long. The southern border of this region is formed by one nearly continuous range, which however bears four different names, Frankenwald, Thüringerwald, Röngebirge, and Spessart. The Frankenwald and the Thüringerwald constitute one range, which lies in the same direction, and might be comprehended under one name, as it is indeed by some German geographers, who calls the whole range Thüringerwald. It begins at the Fichtelgebirge, and extends nearly in the direction of the Forest of Bohemia, bending only a little more to the west. The length of this range somewhat exceeds seventy miles, and its breadth varies from five to eighteen miles. The south-eastern half, or the Frankenwald, hardly rises to more than 2000 feet above the sea, and descends on each side with a gentle slope. Its summit is a narrow but nearly level plain. The Thüringerwald, or north-western portion of the range, has likewise in most places a narrow level plain on its summit, but some points rise much above this level. The Beerberg rises to nearly 3300, the Schneekopf to 3248, and the Inselsberg to nearly 3000 feet; some other points are not much lower. The mean elevation of this range is very little short of 2500 feet. The declivity towards the north-east is very steep, and furrowed by narrow, short, and transverse valleys; but towards the south-west it descends gently, forming long and frequently wide and fertile valleys. The whole range is covered with woods, consisting chiefly of pine-trees. It is mostly composed of granite, gneiss, mica-slate, clay-slate, and hornblende. As the upper part of the range is a level plain, a road is formed along it, which is called the Rennsteig or Rennweg, and generally runs on the watershed between the rivers which fall into the Elbe and into the Werra, a branch of the Weser.

The Röngebirge, or Rön mountains, are separated from the northern part of the Thüringerwald only by the valley of the Werra; but they cannot be considered as its continuation, since they extend north-north-east and south-south-west, forming with the Thüringerwald an angle of less than 80 degrees. It is of comparatively small extent, being only 24 miles long, and on an average 5 miles wide. It divides the waters which flow into the Fulda and Werra from those of the Franconian Saale, which empties itself into the Main. Its mean elevation seems rather to exceed 2000 feet, and some summits rise several hundred feet higher. The Kreuzberg attains 3000 feet, and the Dammersfeld nearly as many; the Eierhunk, 2824 feet. Its summit is mostly a level plain, which slopes down to the north-west gradually, but descends rapidly to the south-east. This range is of volcanic origin, consisting of lava, basalt, porphyry, and tufa, and presents a very dismal aspect, being only wooded on the southern and south-eastern declivity: its summit is covered with extensive moors.

The Spessart extends from the south-western extremity of the Rön mountains, from which it is only separated by a depression, to the most western bend of the river Main as far as Miltenberg. The narrow valley of that river separates it from the Odenwald. Its length may be about 24 miles, and its mean breadth about 10. It does not present a continuous ridge, but consists of a great number of hills, standing in different directions on a base which rather exceeds 1200 feet above the sea. The highest summits are the Geiersberg, 2016 feet, the Hockenhöhe, 1900 feet, and the Granatenberg, 1800 feet above the sea-level. Towards the west the declivities are very gentle, but towards the east rather steep. This range consists of granite, gneiss, mica-slate, and limestone.

The Thüringerwald, the Rön mountains, and the Spessart, form the northern boundary of the elevated plain of Bavaria. The base on which they stand has towards the east an elevation of more than 1500 feet, but it lowers toward the west to 1200 feet. From this elevation the ground declines through the whole central mountain region, at first rapidly, and afterwards more gradually. In the middle of it the base is only 800 feet, and towards its northern

boundary rather less than 600 feet high. Accordingly, we find that nearly all the watercourses, as the Saale, Werra, Fulda, and many others, run off towards the north.

The northern boundary of the central mountain region is not so strongly marked by nature as the southern, except on the east, where it is formed by the Harz mountains. This mountain-range, the most northern in Germany, occupies an area of nearly 800 square miles, between 51° 30′ and 52° N. lat., and 10° and 11° 30′ E. long. It lies nearly parallel to the Frankenwald and Thüringerwald, and about 60 miles from it, and runs east-south-east and west-north-west. Its length is about 55, and its mean width probably does not exceed 18 miles. On the north and south the mountains rise with a rather steep ascent; on the east they sink into an elevated plain, and on the west pass gradually into the hilly tract which joins it in that direction. No continuous ridge can be observed. The range consists of an assemblage of irregular mountain-summits, with generally level tops, covered with earth and with trees. A few of the summits, which consist of granite and hornblende, are bare, and rise higher and with a steep ascent. The valleys between them, some of which are wide and others narrow, lie in every direction. The forests are mostly composed of pine, except to the east, where the mountains are lower, and covered with other trees, as elms, ash, &c. The higher parts are covered with snow from October to May. The nucleus of the Harz is granite, which however is generally covered with porphyry, grauwacke, clay-slate, limestone, gypsum, and sandstone. In the western districts are rich lead-mines, which produce a considerable quantity of silver; in the eastern iron ore is abundant. The highest summits are—the Brocken, 3740 feet, the Königsberg, 3420 feet, the Bruchberg, 3420 feet, the Achtermanns-höhe, 2880 feet, and the Warmberg, 3080 feet above the sea-level. There are some remarkable caverns in it, as the BAUMANNS-HÖHLE. A line drawn from Ilsenburg over the Brocken, the Achtermanns-höhe, and the Bruchberg, divides the whole range into two parts, of which the eastern and lower is called the Lower Harz, and the western and higher the Upper Harz. The same line separates the waters which run to the Elbe and Weser respectively.

The connexion between the Harz mountains and the Thüringerwald is formed at the western extremity of both ranges by an elevated table-land lying south of the Harz, called the Eichsfeld, whose surface is perhaps 1500 feet above the sea-level. From its southern extremity issues a range, which rests on a base about 800 feet high, and runs southward to the Inselsberg in the Thüringerwald, under the names of Hainich, Finne, and Dün. This range has a flat level on its highest parts, but some summits attain an elevation of 1400 or 1800 feet. The hilly country east of this connecting range towards the plain of Saxony is generally fertile.

The western extremity of the Harz mountains is connected with a hilly country, which extends to the Weser, and as far north as Minden. The hills which occupy this district rarely rise to the elevation of mountains, except in the Solling, where the Moosberg attains 1680 feet. This hilly country continues west of the Weser to the Egge, east of Paderborn, which is a narrow range, rising in its highest summits to about 2000 feet, and overgrown with fine forest trees. At its southern extremity (about 51° 30′ N. lat.) the Egge range turns to the west, and runs to the very banks of the Rhine between the rivers Ruhr and Lippe. This latter range is called on the east Aardei, and towards the west Haarstrang. It is a narrow ridge, the most elevated parts of which probably do not exceed 1500 feet, and its mean elevation not 1000 feet. It consists of bare rocks. The Haarstrang, the Egge, the hilly country between the Egge and the Harz, and the last-mentioned range, form the boundary between the low plain and the central mountain-region of Germany. Along this line, towards the north, extends a tract with an undulating surface. It is of inconsiderable width (from 4 to 8 miles), but fertile.

The western declivity of the central mountain-region is formed by three table-lands, of a very uneven surface, which begin on the very banks of the Rhine, and rise gradually as they advance towards the east. The most northern, which is contiguous to the ridge of the Haarstrang to the south, is called the Sauerland, which extends as far southward as the river Sieg, a tributary of the Rhine. On a base of about 500 feet rise several ridges and summits, a few of them to 2500 or 2800 feet. It has mostly a stony surface of very indifferent quality, but it contains copper, coal, and immense quantity of iron-ore. The numerous articles of hardware from this district are well known in Germany. The hills do not advance close to the Rhine, but are separated from the river by a level tract of great fertility.

South of the Sauerland extends the Westerwald, between the rivers Sieg and Lahn. Its western border comes close up to the Rhine, south of Bonn, and is known under the name of the Siebengebirge (Seven Mountains). In some places it extends in level flats, which may be from 500 to 800 feet above the sea; in others it rises in single summits, or ridges. Some of the summits are nearly 2800 feet above the sea. The highest summits in the Siebengebirge are the Löwenberg (1550 feet), and the Oelberg (1550 feet). This part of the Westerwald exhibits some traces of volcanic action. This region is composed of grauwacke, basalt, lava, limestone, and clay-slate. Its soil is stony and dry, and very little adapted for agriculture; a few places only are wooded. Coal is abundant in this tract.

The third hilly plain, which occupies nearly the whole space between the rivers Lahn and Main, is called the Taunus. It very much resembles the Westerwald in its structure, except that it is less elevated and more fertile. The highest summit is the Feldberg, which attains 2760 feet. The Taunus sinks with a steep descent towards the Main and Rhine, but gradually towards the Lahn on the north. It also advances close up to the Rhine, and, with the Westerwald, renders the scenery on that river so interesting between Bonn and Mainz. The Taunus does not join the Spessart, being separated from that range by an extensive hilly tract, which is generally very fertile, especially the Wetterau.

The interior of the central mountain region, or the countries enclosed by the mountain-ranges which we have described, presents nothing but a succession of valleys and high hills. The valleys are frequently wide, but generally of only moderate fertility. The hills have in general a gentle descent, and many of them are cultivated to some height. No hill rises to the elevation of a mountain except the Vogelsberg, north of the Spessart, and west of the Rön mountains, which consists of basalt and lava. It extends about 20 miles from east to west, and 15 from north to south. Its highest part, called the Oberwald, is a level plain, nearly 10 miles in length, and more than 2560 feet above the sea-level; in summer it is always covered with fogs, and in winter with snow. It is surrounded by many summits, which rise to 2300 or 2400 feet. This mountainis-mass is only cultivated in the narrow valleys towards its lower declivities.

The system of the Rhenish mountains, which enclose the elevated plain on the west, rise at their northern extremity, at no great distance from the place where the river Main joins the Rhine, a few miles south of the town of Frankfort. They begin with low hills, which however soon rise to mountains, forming a continuous range, and extending along the bank of the Rhine, south-south-west to the innermost angle of the great bend of the river which is opposite to Basle. The continuity of this range, which extends over a tract of about 180 miles in length, is only interrupted by the narrow valley through which the river Neckar flows. Owing to this circumstance the range is known under two names, the northern being called Odenwald, and the southern Schwarzwald, or Black Forest. The Odenwald advances close up to the Main, between Ostheim and Miltenberg in Bavaria, and is here separated only by a narrow valley from the Spessart, which rises on the other side of the river. It occupies the whole space between this river and the Neckar, whose banks it constitutes between Ebersbach and Heidelberg in Baden. Its length from north to south is about 35 miles, and its width probably not less than 25 miles. It is composed of granite, which is partly covered with limestone or sandstone. Some very high tracts are uncultivated, but by far the greatest portion is covered with trees, or well cultivated, especially towards the east, where it descends with a much more gentle slope than on the side towards the Rhine and in the valleys. The valleys run mostly longitudinally. The single summits lie in the direction of south and north. The highest summit, which is near its southern extremity, is called the Katzerbuckel, and rises to 2320 feet. Farther north are the Neukircher Höhe (1936 feet), the Trumm (1930 feet), and the Malchen, or Melibocus, 1700 feet above the sea. Along

this range runs the Bergstrasse, or mountain-road, to the west of which a plain extends to the Rhine: this plain is generally fertile.

The Schwarzwald, or Black Forest, occupies the remainder of the 180 miles, extending from Ebersbach and Heidelberg, on the Neckar, to Rheinfelder and Waldshut, on the Rhine, over a space about 150 miles long, and varying from 25 to 40 in breadth. About one-third of the range, the most northern portion between Heidelberg and Pforzheim, consists rather of high hills than mountains, and the greater part of it is cultivated to a considerable elevation. The Schwarzwald, south of Pforzheim, forms an enormous mass of rocks, whose higher parts extend in rather level plains, from 2000 to 3000 feet above the level of the sea. On this surface rise a small number of summits in the form of cones. Its nucleus consists of granite, which is frequently covered with porphyry; at its base and on its summits sandstone occurs in many places. Towards the east it descends in long slopes which terminate on elevated ground; but towards the Rhine on the west its declivity is rapid, leaving between it and the river a level space varying from 4 to 20 miles in breadth. On the south, between Rheinfelden and Waldshut, it terminates in a steep declivity on the very banks of the Rhine. The highest summits occur towards the south. The Kandel, north-east of Freyburg, attains 4160 feet; the Feldberg, south-east of Freyburg, 4900 feet; the Belcher, 3600, and the Blaner, 3840. It derives its name from the pine-forest which covers its declivities and higher parts. The soil is rather sterile, and very little adapted to agriculture, and the climate is very cold. Its inhabitants, who are tolerably numerous, gain their livelihood by working in the mines (iron and lead, copper, bismuth, and zinc), and by preparing the produce of the forests for the market; they rear also cattle. In the narrow valleys, which in general run longitudinally, fruits are raised in abundance.

The Elevated Plain or the table-land of Bavaria, which extends between the Schwarzwald and Odenwald on the west to the Böhmerwald on the east, as far north as the Thüringerwald and Rön mountains, is bounded on the south by the Alps, from which it is divided by a line running from Lindau on the Bodensee, or lake of Constance, nearly east through Kempten and Benedictbaiern to Neubaiern on the Inn, and then following the course of this river to its mouth at Passau. Its length from north to south is about 180 miles, and its mean breadth probably exceeds 120 miles. The western portion of this plain has a much more uneven surface than the eastern. Between the sources of the Neckar and Danube a high ground begins on the eastern declivity of the Schwarzwald, and extends in a north-eastern direction through the plain, until it sinks down to its level at the sources of the river Iaxt, about 90 miles from its origin. This high ground separates the waters which fall into the Neckar and into the Danube, and is called the Rauhe Alp. Consisting of the same kind of limestone which constitutes the Jura mountains in the western districts of Switzerland, it is considered as a prolongation of that range, which is supposed to be interrupted by the valley of the Rhine between Schaffhausen and Basle. On the banks of the Danube it has not the appearance of a mountain-range. It rises as a gently inclined plain continually for 12 or 16 miles and more, until it has attained its greatest elevation, which on an average may be 2500 feet, when it sinks in a steep descent towards the rivers which fall into the Neckar. The highest summits occur near the sources of the Danube and Neckar, where the Delingerberg, the Schafberg, and the Hohenberg attain about 3300 feet; but farther east the few summits that occur hardly rise a few hundred feet above the inclined plain. The soil of this plain is extremely dry, as the limestone quickly absorbs the water. It has on it some small woods, mostly of beech, but the greater part is covered with a coarse grass, affording only pasture for sheep. The country south of the Rauhe Alp, as far as the foot of the Alps, is from 1800 to 2000 feet above the level of the sea. It is traversed by numerous ridges of low hills, running south and north, but the wide valleys which lie between them are fertile, well peopled, and cultivated, though their cold climate does not favour the growth of several productions which succeed in the districts north of the Rauhe Alp.

That portion of the elevated plain which extends between the Rauhe Alp and the Schwarzwald, and is mostly drained by the Neckar and its branches, has a strongly undulating surface, but the hills rarely rise to a considerable height. The valleys are wide and fertile, and as their elevation above the sea on an average does not exceed 1000 feet, and most of them are well sheltered, they are productive in wine and in every kind of grain. This tract is considered the most pleasant and fertile part of Germany, except the valley of the Rhine.

The eastern portion of the elevated plain is divided into two parts by the Danube. On the south of that river there are many level plains which extend frequently 30 miles in length. Most of them have a fertile and well cultivated soil; others are disfigured by swamps and morasses. [Bavaria, vol. iv., p. 50.] Towards the foot of the Alps these plains are from 1800 to 2000 feet above the sea, but towards the Danube they sink down to 1200 or 1000 feet. Some isolated rocks rise with a steep ascent a few hundred feet above it.

On the north of the Danube the country begins to rise immediately from the banks of the river, and continues rising for several miles, till it has attained an elevation of 1400 to 1500 feet above the sea-level: it then extends in a nearly level plain, which is from 20 to 30 miles across and over which the line of separation runs between the streams that descend to the Danube and the Main. On the north-east, towards the foot of the Fichtelgebirge, about the sources of the rivers Pegnitz, Vils, and Roth (Red) Main, the plain rises to 2000 feet in the table-land of Thurndorf. This high plain, which is called the High Ground of Franconia (Der Franckische Landrücken), is rather cold in winter, but its soil is far from being sterile, though some sandy tracts occur, and others are covered with extensive woods. The northern slope of this High Ground is very gradual, occupying a tract about 30 miles in width, and terminating on the bank of the Main at an elevation of 800 to 600 feet above the sea. This tract, which is of greater fertility than the High Ground, produces rich crops of grain; towards the Main good wine is made. Its surface is rather undulating, and a few ranges of hills occur, as the Steigerwald near the banks of the Main, whose highest summit, called the Schwammberg, attains 2336 feet. The northern part of the plain, which occupies the country north of the river Main, and extends into the angle formed by the Rön mountains and the Thüringerwald, is much more hilly. It is mostly covered with extensive forests, but it contains also some wide and fertile valleys.

The fourth natural division of Germany comprehends the Alps and their numerous valleys, of which a description is given under Austria, vol. iii., p. 130-132.

That part of Germany which lies on the left bank of the Rhine contains level tracts only along the river, the greater part of it being occupied by mountain-ranges which partly constitute the northern extremity of the Vosges mountains, and partly the eastern districts of the Ardennes. The Vosges enter Germany as a broad-backed range, and descend rapidly towards the flat tract, which, with a mean breadth of eight or ten miles, separates them from the Rhine; they lower gradually towards the west, where they terminate in a flat level of moderate extent. The highest summit in this part is the Kalmuck, which attains about 2200 feet. The Vosges terminate properly at Kaiserlautern, where a valley, about 50 miles long and 4 wide, extends from the Rhine to the Saar; its mean elevation is 800 feet above the sea, and it is partly covered with moors. North of this valley lies a rather extensive mountain-tract, which may be considered as a continuation of the Vosges. Its eastern part is known by the name of Donnersberg (thunder-mountain), whose highest summit, the Königstuhl, attains an elevation of 2240 feet; west of the Donnersberg is the Hochwald, the Idarwald, and north-west of it the Hundsrück. The Hochwald forms the highest part of the whole, rising in the Walderbsenkopf to nearly 2700 feet. The Iderkopf, in the Iderwald, attains [illegible]6 feet; and the Oppeler Höhe, in the Hundsrück, 2112 feet. The last-mentioned range terminates in steep rocks on the very banks of the Rhine, between Bingen and S. Goar, opposite the Taunus. This mountainous region consists mostly of grauwacke and slate, and its upper part presents an undulating but bare surface; some parts are well wooded. The valleys along the water-courses are of moderate fertility, but cultivated with great care. This mountain-region occupies the whole tract between the valley of the Rhine and the rivers Moselle and Saar.

On the other side of the Moselle is the Eifel, which may

be considered as a part of the Ardennes, and is only separated from the Hochwald and Hundsrück by the deep valley in which the Moselle runs. It extends on the very banks of the Rhine as far north as Bonn, and its descent towards the river is exceedingly steep between Andernach and Sinzig. Westward it advances about thirty miles, until it joins the Ardennes. This extensive rocky mass has lately attracted the attention of geologists. Its upper surface, which appears rather as a plain of a very rugged surface, on which several summits rise to some height, is partly covered with sand and swamps, and partly with pumice-stone and lava. There are numerous depressions, mostly filled with water, which have been recognised as extinct volcanoes. From one of these depressions, called the lake of Laach (750 feet above the sea), a lava-tract extends five miles in length, and nearly three miles in width, to the small river Nette. This mountain-mass consists mostly of limestone, slate, and basalt. In some parts it is covered with stunted trees, and in others is a complete desert. The highest summits upon it are the Hochacht, composed of basalt, which attains 2336 feet; the Schneifel is 2940 feet, and the Ernstberg is about the same height. The north-western part of the Eifel is the Hohe Veen (called by the French Haut Fanges), a mountain plain, extending about fifteen miles in every direction. Its surface rises and lowers imperceptibly, and very few summits occur on it; but as its elevation is from 1800 to 2200 feet above the sea-level, it is very sterile, mostly covered with swamps, and nearly all the year round enveloped with fogs, so that it is dangerous to cross it.

The Eifel and the Höhe Veen constitute the southern boundary of the low plain on the west of the river Rhine. In this part the plain extends over Belgium and the southern provinces of the Netherlands. Though the districts united to the Netherlands are not much superior in fertility to that part of the low plain which lies on the other side of the Rhine, those which form Belgium and which belong to Germany exhibit a different character, being fertile to a considerable degree.

Climate.—The climate of the different parts of Germany differs in no great degree, if we except the countries situated on the southern declivity of the Alps and its valleys. At Trieste, on the Adriatic Sea, the mean annual temperature is 58°; but north of the Alps, the temperature is nearly equal all over Germany. Though the northern districts are seven or eight degrees farther north than the southern, the difference of temperature due to this cause is compensated by the much higher elevation of the southern districts. The mean annual temperature varies only between 45° and 50° of Fahrenheit (that of London is 48°), as may be seen in the following table:—

Königsberg, in Prussia	43·5°
Sagan, in Silesia	46·5
Ingolstadt, in Bavaria	45·5
Breslau, in Silesia	46·2
Iena, in Saxony	46·3
Ratisbon, in Bavaria	46·4
Tübingen, in Würtemberg	46·4
München, in Bavaria	47·0
Erfurt, in Prussia	47·1
Göttingen, in Hannover	47·8
Berlin, in Prussia	49·2
Prag, in Bohemia	49·3
Karlsruhe, in Baden	49·7
Frankfort, on the Main	50·0
Stuttgard, in Würtemberg	49·7
Trier, in Rhenish Prussia	50·0
Würzburg, in Bavaria	50·2
Manheim, in Baden	49·7
Wien, in Austria	50·8
Düsseldorf, in Rhenish Prussia	50·8

In the greatest degree of cold which has been experienced, the thermometer sunk to 31° below zero, and in the greatest degree of heat it rose to 95°. The countries along the banks of the rivers Rhine and Main enjoy the mildest climate, and here the almond-tree and the chesnut-tree succeed very well. Vines do not grow north of 51° N. lat., unless peculiar care is taken to shelter them.

The low plain, which lies exposed to the winds that blow from the northern seas, has a much moister and more variable climate than the interior, which, owing to its greater elevation, is much drier and less subject to sudden and frequent variations. The quantity of rain which annually falls varies greatly with the localities of places. It amounts at Wittenberg to eighteen, at Berlin to twenty-one, at Ulm to twenty-eight inches.

(Gutsmuth, *Deutsches Land;* Hoffmann's *Deutschland und seine Bewohner;* Stein; Hörschelmann.)

For the present political divisions of Germany, see EUROPE, vol. x., p. 89.

Antient Germany.—The word Germania was employed by the Romans to designate a country of greater extent than modern Germany. They included under this name all the nations of Europe east of the Rhine and north of the Danube, bounded on the north by the German Ocean and the Baltic, including Denmark and the neighbouring iaslnds, and on the east by the Sarmatians and Dacians. It is difficult to determine how far Germany stretched eastwards. According to Strabo (vii., c. 1) Germanic tribes dwelt nearly as far as the mouths of the Borysthenes (Dnieper). The northern and north-eastern parts of Gaul were also known under the name of Germany in the time of the emperors, after the province of Belgica had been subdivided into *Germania Prima* and *Germania Secunda.* [FRANCE, vol. x., p. 423.]

The Greeks and Romans had very little knowledge of Germany before the time of Julius Cæsar, who met with several German tribes in Gaul, and crossed the Rhine more than once, rather with the view of preventing their incursions into Gaul than of making any permanent conquests. His acquaintance was however limited to those tribes which dwelt on the banks of the Rhine. Under the early Roman emperors many of these tribes were subdued, and the country west of the Visurgis (Weser) was frequently traversed by the Roman armies. But at no period had the Romans any accurate knowledge of the country east of this river; and it is therefore difficult to fix with certainty the position of the German tribes, particularly as the Germans were a nomad people. Some parts of Germany were inhabited by the Gauls, who were, according to Cæsar (*Bel. Gal.*, vi. 24) the more warlike nation in early times. Two great countries of Germany, Bohemia (Boihemum), and Bavaria (Boioaria), derived their names from the Boii, a Gallic tribe.

The name of Germani was first applied by Cæsar to the whole nation east of the Rhine, though it properly belonged only to those tribes which he conquered in Gaul. Tacitus states (*Germ.*, c. 2) that the first tribe which crossed the Rhine were the Tungri, who were afterwards called Germani, which is supposed to be the same as *Wehrmann;* that is, 'man of war.' It is doubtful whether the Germans themselves employed any one name to designate the whole nation. Tacitus (*Germ.*, c. 2) divides them into three tribes: 1. Ingævones, bordering on the ocean. 2. Hermiones, inhabiting the central parts. 3. Istævones, including all the others. Pliny (*Nat. Hist.*, iv. 14) makes five divisions: 1. Vindili, including Burgundiones, Varini, Carini, Guttones. 2. Ingævones, including Cimbri, Teutoni, and Chauci. 3. Istævones, near the Rhine, including the midland Cimbri. 4. Hermiones, inhabiting the central parts, including the Suevi, Hermunduri, Catti, and Cherusci. 5. Peucini and Bastarnæ, bordering on the Dacians.

The following list gives the position of the principal tribes as far as they can be ascertained: further particulars will be found in some separate articles, such as CATTI, CHAUCI, CIMBRI, &c.

1. *Tribes on the sea-coast.*—Between the Rhenus (Rhine) and the Amisia (Ems), the Frisii. Between the Amisia and the Albis (Elbe), the Chauci, divided into Chauci Minores and Chauci Majores. East of the Albis, the Cimbri, Saxones, and Angli. The peninsula of Jutland was also called Cimbrica Chersonesus. Farther east the Guttones and Teutones or Teutoni.

2. *Tribes on the right bank of the Rhine.*—Between the Frisii and the Luppia (Lippe), and bounded on the east by the Visurgis, the Bructeri, Tubantes, Chamavi, Marsi, Dulgibini, Angrivarii, Usipii or Usipetes. The Usipii, in conjunction with the Tencteri, made an irruption into Gaul in the time of Cæsar (Cæs., *Bel. Gal.*, iv., 1-15). Between the Luppia and Mœnus (Mayn), the Sigambri or Sicambri, Tencteri, and Mattiaci. South of the Mœnus, the Alemanni.

3. *Tribes on the left bank of the Danube.*—Between the Danube and the Erzgebirge and Riesengebirge, the Hermunduri, Narisci, Quadi, and Marcomanni, who dwelt in the districts formerly inhabited by the Boii.

4. *Tribes in the Central parts.*—The most powerful of

these were the Suevi, who occupied the greatest part of Germany, and were composed of several tribes. They extended from the Erzgebirge and Riesengebirge as far north as the Baltic, and included the Semnones, Langobardi, Aviones, Varini, Eudoses, Suardones, and Nuithones. South of the Chauci were the Cherusci and Chasuarii, and south of these the Catti. The Osi, Marsigni, Gothini, and Burii, probably inhabited part of Prussian Silesia. The Burgundiones and Lygii dwelt on the banks of the Vistula, bounded on the south by the Carpathian mountains, and on the west by the Riesengebirge.

History.—The origin of the Germanic nations, like that of all others, is uncertain. Some authors, taking as their guide the affinity of languages, have traced their descent from the inhabitants of Asia; and Von Hammer calls them a Bactriano-Median nation. But to assign to the Germanic nations a distinct historical origin is to make an assertion without evidence, though it is now indisputably established that the Teutonic dialects belong to one great family with the Latin, the Greek, the Sanscrit, and other European and Asiatic tongues. All the positive knowledge however that we have of the German nations previous to their contact with the Romans is exceedingly vague and mere conjecture. The Romans first became acquainted with them, B.C. 113, when they appeared under the name of Cimbri on the confines of the Roman dominion and defeated the consul Papirius Carbo. They made successive attacks on the frontiers, but were repelled by Marius, who defeated these barbarians in the years 103 and 101 B.C. When Julius Cæsar had subjugated Gallia and penetrated to the Rhine, he became acquainted with a nation then designated by the name of Germans. Ariovistus, the leader of the nation which had formerly inhabited the banks of the Danube, attempted to establish himself in Gallia; but being defeated by Cæsar, was obliged to fly beyond the Rhine. Cæsar twice crossed the Rhine in order to secure Gallia from the inroads of the barbarians: he took some Germans into his army, whom he employed against the Gauls, and afterwards against Pompey. He himself was only acquainted with the tribes of the Ubii, Sigambri, Usipetes, and Tencteri: he was told that the remaining part of Germany was inhabited by the Suevi, who possessed a hundred districts, every one of which yearly sent out one thousand men on predatory expeditions.

The civil wars which divided the Romans withdrew their attention for some time from Germany, and the Sigambri ravaged Gallia with impunity. After they had defeated Lollius, the legate of the Emperor Augustus (B.C. 15), he himself hastened to the defence of Gallia (Vell. Pat. ii. 97); and in order to oppose the inroads of the Germans, he erected several fortresses on the Rhine, and gave his stepson Drusus the command of the forces stationed on the banks of that river. Drusus made several successful expeditions against the Germanic nations, and penetrated as far as the Elbe. After the death of Drusus (B.C. 9), his brother Tiberius commanded for two years the legions stationed on the Rhine. Tiberius employed policy rather than force against the Germans. He engaged many of them to enter the Roman service; and when he was again (A.D. 4) entrusted with the same command, he penetrated as far as the banks of the Elbe; and Germany would have perhaps become a Roman province if the imprudence of his successor, Quintilius Varus, had not destroyed all the advantages already gained. The violent measures which he adopted to change the manners and institutions of the Germans caused a general conspiracy against the foreign invaders. Arminius, who was educated at Rome, and who had served in the Roman armies, was at the head of this conspiracy. The legions of Varus were attacked by the Germans in the forest of Teutoburg (A.D. 9), and entirely destroyed. This defeat of the Romans was followed by the loss of all their conquests beyond the Rhine; and the Germanic nation of the Cherusci, among whom Arminius was born, became the most powerful nation in Germany. Four years afterwards, Germanicus restored for a time the fortunes of the Roman arms, but without regaining the former acquisitions. From that time the Romans seem to have abandoned the idea of extending their conquests in that direction, and to have contented themselves with repelling the inroads which the Germans occasionally made on their frontiers. The Germans were also prevented from making any serious attempts against the Romans by the internal wars which distracted them for many years. They again attacked th Roman empire under Domitian, Nerva, and Trajan, the last of whom entirely defeated them. From this time their attacks on the Roman empire became more frequent and more formidable, and their history becomes blended with that of the decline of the Roman empire, on the ruins of which they established several new states. We shall pass over the period to the death of Charlemagne, under whose successors the modern history of Germany begins. Those who would study the state of Antient Germany may refer to the 'Germania' of Tacitus, and to the work of Mannert on Antient Germany, published in 1829, as well as to several other German works on the subject, but particularly those of Barth and Ledebuhr.

Modern History.—Louis, surnamed the Germanic, son of Louis Le Debonnair, and grandson of Charlemagne, was, by the treaty of Verdun, 843, the first king of the Germans. Germany was divided at that time from France by the Rhine, and possessed on its left bank only Spires, Worms, and Mainz, with their respective districts. These territories were given to the Germanic or Eastern Empire on account of their vineyards, in which the other parts of the empire were at that time deficient. Under the reign of Louis were established the margraves; and burgs, that is, fortified towns or castles, were founded in order to prevent the inroads of the Normans as well as of the Sclavonians. This emperor increased his dominions by the acquisition of Cologne, Treves, Aix-la-Chapelle, Utrecht, Metz, Strasburg, Basle, and many other towns and districts which he inherited from his nephew, Lotharius the Second. Louis died in 876, and his three sons, Carloman, Louis the Younger, and Charles the Fat, divided his empire. In 884 Germany was re-united to France by the accession of Charles the Fat to the throne of the last-named country, who thus became sovereign of almost all the empire possessed by his great predecessor Charlemagne. But he proved unequal to the difficult task of governing such extensive dominions, and sunk into such contempt with his subjects, that the Germans (in 887) renounced their allegiance to him, and raised to the throne his nephew, Arnulph of Carinthia, a natural son of his brother Carloman. Arnulph was for a long time involved in difficult wars with the Sclavonians of Moravia, against whom he called in the Hungarians, who had settled in their present country in 889: he was crowned emperor in 896, after a victory over Berengar, duke of Friuli. He died in 899, and was succeeded by his infant son Louis, who died in 911, and with whom the Carlovingian dynasty ended in Germany. Otho, duke of Saxony, having refused the imperial dignity on account of his great age, Conrad, the first duke of Franconia, was elected emperor of Germany. After Conrad's death (918), Henry the Fowler, duke of Saxony, was elected emperor. From that time the crown of Germany remained elective until the 6th of August, 1806, on which day the emperor Francis the Second abdicated the imperial crown of Germany, and declared the dissolution of the Germanic empire. Henry the Fowler died in 936, and the imperial dignity continued in his house under Otho I., who died in 973; Otho II., who died in 983; and Otho III., who died in 1002. The emperors of Germany assumed the title of Roman emperors from the time of Otho I., who was crowned at Rome in 962: when a successor to the throne was elected during the emperor's lifetime, he was called the king of Rome. Henry II. reigned from 1002 to 1024. Conrad the Second (1024-39) organized the feudal system, and first endeavoured to put an end to the factions and quarrels then universally prevalent, by the establishment of the so-called peace of God, Freuga Dei. He extended the limits of the empire by the incorporation of Burgundy. His successor, Henry the Third (1039-56), humbled the Roman see by deposing three successive popes, but the papal influence was again restored by Gregory the Seventh, who maintained a protracted struggle with the emperor Henry the Fourth (1056-1106).

The crusades began during the reign of this emperor, which was constantly disturbed by his quarrels with the Roman see, as well as with the powerful vassals of the German empire. Henry the Fifth (1106-25), son of the foregoing, was a prince without any talents, and of a bad character. Under his reign the great vassals of the empire became entirely independent, and thus the division of Germany into several states was established. He was followed by Lotharius the Second, or the Saxon count of Supplin-

burg (1125-37), who became emperor by making great concessions to the church.

The successor of Lotharius was Conrad III., duke of Franconia, of the family of Hohenstaufen (1138-52). He was constantly devoted to the Roman see and greatly increased the influence of the clergy. Conrad was succeeded by his nephew, Frederick I., or Barbarossa (1152-90), a prince of ability, whose reign is memorable for the establishment of the Hanseatic League. His life was spent in constant wars with the Italian republics and the Pope; and he died on his expedition to the Holy Land. Frederick Barbarossa was succeeded by his son Henri VI., who having married a princess of Naples, possessed himself of that kingdom as well as of Sicily, where he died in 1197. The peace of the empire was disturbed for some time by the competition between Philip, brother to the late emperor, and his nephew, Otho of Saxony. The dispute was settled by an arrangement that Philip should have the crown, and that Otho should succeed him. The former died in 1208, and the latter, who became emperor under the title of Otho IV., was driven from the throne by Frederic II., son of the emperor Henri VI., who was crowned in 1215. Frederic II. died in 1250: his reign, after that of Charlemagne, is perhaps the most remarkable period of the middle ages. His son, Conrad IV., was opposed by William of Holland, and died in 1254. Upon Conrad's death there were several competitors for the Imperial crown, among whom was Richard, earl of Cornwall, brother of Henry III. of England. The parties who supported the different competitors took advantage of the disturbed state of the empire in order to strengthen their own power. Peace was restored by the accession of Rudolph I., count of Habsburg (1272-91). This great prince destroyed the strongholds of the nobles, who exercised constant depredations on the adjacent country, and established order by severe measures. Rudolph is the founder of the Habsburg dynasty, which through a female line still reigns in Austria. After his death, Adolphus, duke of Nassau, was elected emperor. He was killed in battle in 1298, and Rudolph's son, Albert I. of Austria, ascended the throne. Albert's reign (1298-1308) is rendered remarkable by the emancipation of the Swiss from Austr a. Albert was succeeded by Henry VII. of Luxembourg, whose reign was spent in constant wars in Italy, which at that time was divided between the Guelph and the Ghibeline parties.

After Henry's death Louis of Bavaria was elected emperor; his reign (1314-47) was marked by frequent wars in Italy. He was succeeded by Charles IV. of Luxembourg, king of Bohemia, whose reign (1346-78) is particularly remarkable by the constitution of the empire which he proclaimed (in 1356) under the name of the Golden Bull. This constitution regulated the rights, privileges, and duties of the electors; the manner and formalities of the election and coronation of an emperor; the coinage, customs, and other articles relating to the commerce of the empire; the rights and obligations of the free imperial cities, &c. Charles's son, Wenceslaus (1378-1410), was a weak prince whose reign was disturbed by internal commotions and distinguished by the commencement of Huss's reformation. After the death of Wenceslaus, his brother Sigismund ascended the throne (1411-37). During his reign the council of Constance was held, when Huss was executed, a transaction which gave rise to the wars of the Hussites. Sigismund was succeeded by Albert II. of Austria (1437-39), whose short reign presents no particular event.

The long reign of Albert's successor, Frederick III. (1439-93), a weak-minded prince, was marked by the great progress of science, which was promoted by the foundation of many universities in Germany. Frederick's son, Maximilian I. (1493-1519), was a prince of a superior mind and character. He put an end to many abuses which had desolated the empire, particularly private feuds. He improved the organization of the courts of justice, introduced a system of police for the better security of the inhabitants, and established (in 1516) the post. He gave also a new and better organization to the army, being himself an accomplished military commander. It was also during his reign that the reformation of Luther began (1517), at the university of Wittemberg, which had been founded in 1502.

Maximilian was succeeded by his grandson, Charles V., king of Spain. After the abdication of Charles in 1556, he was succeeded by his brother, Ferdinand I., who was of a conciliatory character, and granted entire toleration to the Protestants. Ferdinand's son and successor, Maximilian II., reigned from 1564 to 1576; and his son Rudolph II., from 1576 to 1612. Rudolph was a weak-minded prince, who neglected the duties of his exalted station, and occupied himself with chemistry, astrology, and mechanics. Although a zealous Roman Catholic, he was obliged to grant to his hereditary Bohemian subjects the full enjoyment of religious liberty. Under his successor Matthias (1612-19), the Thirty Years' War commenced in 1618. Matthias was followed by Ferdinand II. (1619-37), a bigotted Roman Catholic, whose fanatical zeal against the Protestants, as well as his political ambition, continued to involve Germany in the Thirty Years' War. Ferdinand III., son of the preceding, reigned from 1637 to 1657. The treaty of Westphalia, which terminated the war in 1648, established a new organization of the German empire. By this treaty, which served as the basis of the constitution of Germany till the formation of the Confederation of the Rhine in 1806, the religious and political liberties of the Germans were established on a sure footing. The sovereignty of the states of the empire was acknowledged, as well as their right to form alliances among themselves and with foreign states, provided none were concluded against the emperor or the empire. It was also declared that the emperor should not, without the consent of the states, put any one of them under the ban of the empire. The Palatine of the Rhine, who had lost his states, recovered them by that treaty and was created an elector. The Protestants were confirmed in all the liberties which they possessed before the war, and the estates of the Roman Catholic church, which had been seized by the Protestants and possessed by them in 1624, were left in their hands, but those seized after this time were restored to the Roman Catholics. The members of the Reformed Church received equal rights with the Lutherans. Several bishoprics and abbeys were secularized, and given as an indemnity to different states. All the sovereigns were put under an obligation not to persecute their subjects who professed a religion different from their own. Alsatia was ceded to France; Sweden received a part of Pomerania, Bremen, Verden, Wismar, and a sum of five million dollars for its army; Brandenburg received the secularized bishoprics of Halberstadt, Minden, Kamin, and the expectation of the possession of Magdeburg; Mecklenburg, the secularized bishoprics of Schwerin and Ratzeburg. Hanover was invested with the right to have one of its princes created, alternately with a Roman Catholic, sovereign bishop of Osnabrück, and also received some convents with their estates. The abbey of Hirschfeldt and 600,000 dollars were given to Hessen Cassel. Austria consented to all these measures in order to preserve her hereditary states. Holland was acknowledged by Spain as an independent state. France and Sweden declared themselves guarantees of all the provisions of the abovementioned treaty. Leopold I. (1657-1705), was involved in constant wars with France and with the Turks, who besieged his capital, Vienna, which was saved by John Sobieski, king of Poland. Leopold granted in 1692 the electoral dignity to the duke of Brunswick-Lüneburg, and conferred in 1701 the royal crown on the elector of Brandenburg, who took from that time the title of king of Prussia.

The whole reign of Leopold's son and successor, Joseph I. (1705-11), was occupied in the war of the Spanish succession. He was succeeded by his brother Charles VI. (1711-40), with whose death the male line of the Habsburg dynasty became extinct, and his only daughter, Maria Theresa, succeeded to the throne of the hereditary states of Austria.

The elector of Bavaria, who was elected emperor in 1742, put forward claims to the succession of the Austrian states, and other sovereigns took advantage of that circumstance to attack Maria Theresa, who was married to the duke of Lorraine. A war ensued, which was ended by the peace of Aix-la-Chapelle in 1748; but the emperor Charles VII. having died in 1745, the husband of Maria Theresa was elected emperor under the name of Francis I. In his reign the Seven Years' War was concluded by the treaty of Hubertsburg in 1763. Francis was succeeded in 1765 by his son Joseph II., who distinguished himself by the numerous reforms which he introduced into his dominions, and particularly by his act of toleration to all the religious persuasions, proclaimed in 1781. Joseph was succeeded, 1790, by his brother, Leopold II., who had been duke of Tuscany before his accession to the imperial throne. The short reign of Leopold is marked by the treaty of Pilnitz, which he concluded

in 1791 with the king of Prussia against the French. Leopold was succeeded in 1792 by his son, the late emperor Francis, who, after the formation of the Rhenish Confederation, having resigned the title of Emperor of Germany, took that of Emperor of Austria. The Confederation of the Rhine was established by an act, signed at Paris on the 12th of July, 1806, by the kings of Bavaria and Wirtemberg, the elector of Mainz, the elector of Baden, the duke of Cleves and Berg (Murat), the landgrave of Hesse-Darmstadt, the princes of Nassau-Usingen, Nassau-Weilburg, Hohenzollern-Hechingen, Hohenzollern-Siegmaringen, Salm-Salm, Salm-Kyrburg; the duke of Aremberg; the princes of Isenburg, Birstein, Lichtenstein, and the count of Leyen. By this act the elector of Mainz received the title of the Prince Primate; the elector of Baden, the landgrave of Hesse-Darmstadt, and the duke of Berg, received the titles of grand-dukes, with royal rights and privileges; the prince of Nassau-Usingen received the ducal, and the count of Leyen the princely dignity. The French emperor declared himself Protector of the Confederation. By the establishment of this confederation many towns and principalities lost their political existence: such were the imperial city of Nürnberg, which was given to Bavaria; and Frankfort, which was given to the prince primate. Several petty sovereign princes were by the same act mediatised, or deprived of their sovereign rights, such as making laws, concluding alliances, declaring war, coining money, &c.: they retained their hereditary estates, but became subjects to the sovereigns who were members of the Confederation. The object of the Confederation was declared to be, the maintenance of external and internal peace by the mutual assistance of all the members of the Confederation as well as of France, in case any one of them should be attacked by an enemy. The affairs of the Confederation were to be conducted by a congress sitting at Frankfort on the Main, and divided into two colleges—the royal one, in which the grand-dukes had also their seats, and the princely one. The president of the congress in general, and of the royal college in particular, was the Prince Primate, but the president of the princely college was the duke of Nassau. The elector of Würzburg joined the Confederation in the same year, and the king of Prussia meditated the establishment under his own protection, of a similar Confederation, composed of the princes of Northern Germany, in order to counterbalance the power of the Confederation of the Rhine. This project was destroyed by the war of 1806, which was not over when the elector of Saxony, who had received the title of king, by his treaty with France, on the 11th of December, 1806, joined the Confederation, and his example was followed by all the Saxon princes. By the treaty of Warsaw, on the 13th April, 1807, the two princes of Schwarzburg, the three ducal lines of Anhalt, the princes of Lippe Dettmold and of Lippe Schaumburg, and the princes of Reuss, were received members of the Confederation, which was increased by the accession of the newly-erected kingdom of Westphalia, as well as that of both the dukes of Mecklenburg, and of the duke of Oldenburg. Thus in 1808 the Confederation comprehended 5916 geographical square (German) miles, with a population of 14,608,877 souls; the army of the Confederation, which was fixed in the beginning at 63,000, was increased to the number of 119,180. The act of the Confederation was violated by its protector himself, who united with France, by a decree of the 10th December, 1810, all the country situated between the mouths of the Schelde and the Elbe, and deprived many sovereign princes of their dominions, taking away from the Confederation of the Rhine an extent of 532 geographical square (German) miles, with a population of 1,133,057. Napoleon did not observe any better the promise which he gave at the establishment of the Confederation not to meddle with its internal affairs, but treated it in every respect as one of his provinces. The events of 1813 put an end to the Confederation of the Rhine; and the Congress of Vienna established, in 1815, the Germanic Confederation, composed of all the states of Germany. The present Germanic Confederation, established by an act of the Congress of Vienna on the 8th June, 1815, consists of thirty-eight Independent States enumerated in the Statistical Tables of EUROPE.* The central point and the organ of the Confederation is the Federative diet, which sits at Frankfort on the Main. Its sessions were opened on the 5th of November, 1816. It exercises its authority in a double form: 1, as a general assembly, called Plenum; and 2, as a minor council, or the Federative government. The Plenum meets only whenever an organic change is to be introduced, or any affair relating to all the Confederation is to be decided. The Plenum contains seventy votes, of which Austria and the eight German kingdoms have each four votes, and the other states, in proportion to their importance, three, two, or one vote each. The Federative government is composed of seventeen votes, out of which eleven principal states have each a single vote, and the remaining twenty-seven only six joint votes. Austria presides in both the assemblies, and decides in case of equality. The Federative government has the initiative, and deliberates on the projects which are presented to the Plenum, where they are not debated, but simply decided by a majority of ayes or noes. It executes the enactments of the Plenum, and despatches the current business of the Confederation. It decides by a simple majority, and seven votes form a quorum. The meetings of the Federative diet are either those wherein preparatory debates take place, but no protocols are made, or those wherein affairs are finally decided.

The object of the Germanic Confederation and the duties of the Federative diet are—the maintenance of external security or mutual defence from a common enemy, and the preservation of internal peace among the Federative states, which have no right to declare war on each other, but must submit their differences to the decision of the diet. The maintenance of internal security comprehends not only the prevention of conflicts among the Federative states, but also the suppression of any attempt by the subjects of any of the states to subvert the existing order of things. It was in consequence of this principle that the central commission of inquiry into revolutionary measures was established at Mainz in 1819-28. A further development of the same principle, occasioned by the revival of liberal opinions throughout Germany by the French Revolution of July, was made on the 28th June, 1832, by the proclamation of the following articles, particularly directed against the constitutional states of Germany:—1st. The German sovereigns are not only authorised but even obliged to reject all propositions of the states which are contrary to the fundamental principle, that all sovereign power emanates from the monarch, and that he is limited by the assent of the states only in the exercise of certain rights. 2. The stoppage of supplies by the states, in order to obtain the adoption of their propositions, is to be considered as sedition against which the Confederation may act. 3. The legislation of the federative states must never be in contradiction either to the object of the Federation or to the fulfilment of federal duties; and such laws (as for instance, the law of Baden, which established the liberty of the press) may be abolished by the diet. 4. A permanent commission of federal deputies shall watch over the legislative assemblies of the federal states, in order that nothing contrary to the federal act may occur. 5. The deputies of the legislative assemblies of the federal states must be kept by the regulations of their governments within such limits that the public peace shall not be disturbed by any attacks upon the Confederation. 6. The interpretation of the federal laws belongs exclusively to the federal diet. On the 5th July, 1833, the federal diet proclaimed a new law consisting of the following 10 articles: 1. All German works containing less than 20 sheets which appear in foreign countries cannot be circulated in the federal states without the authorization of the several governments. 2. Every association having a political object is prohibited. 3. Political meetings and public solemnities, except such as have been established for a long time and are authorized, cannot be held without the permission of the several governments. 4. All sorts of colours, badges, &c. denoting a party are proscribed. 5. The regulations for the surveillance of the universities, proclaimed in 1819, are renewed and rendered more severe. By the remaining 5 articles the federative states pledged themselves to exercise a vigilant watch over their respective subjects, as well as over foreigners residing in their states, in respect of revolutionary attempts; to surrender mutually all those individuals who had been guilty of political offences, with the exception of their own subjects, who are to be punished in their own country; to give mutually military assistance, in case of disturbance, and to notify to the diet all measures adopted with reference to the above-mentioned objects.

* To those marked with an asterisk in EUROPE (vol. x., p. 89) as sovereign states must be added, Frankfort on the Main, Holstein and Lauenburg, and Luxemburg. Schwarzburg and Reuss are each to be reckoned as two.

On the 30th October, 1834, the meeting of the Federative diet unanimously agreed to the proposition of Austria, to establish a tribunal of arbitration in order to decide differences which might break out in any state of the Confederation between the government and the chambers respecting the interpretation of the constitution, or the encroachments on the rights of the sovereign by the chambers, or their refusal of subsidies. This tribunal consists of 34 arbitrators nominated by the seventeen members of the minor council, each member nominating two arbitrators.

Constitution of the German Empire as it was before the French Revolution.—The states of the Germanic empire consisted of the following members, divided into three colleges, or chambers:—

I. The Electoral College, which consisted of the Ecclesiastical Electors.

1. The archbishop of Mainz, arch-chancellor of the empire for Germany.

2. Archbishop of Treves, arch-chancellor of the empire for Gallia and the kingdom of Arles (a purely titular office).

3. Archbishop of Cologne, arch-chancellor for Italy (also a titular office).

II. The Secular Electors were—

4. The king of Bohemia, arch-cupbearer of the empire: he presented the emperor at the coronation banquet with a cup of wine and water.

5. The elector of Bavaria, arch-carver of the empire: he bore at the coronation-procession the golden bull before the emperor, and presented to him the dishes at the banquet.

6. The elector of Saxony, arch-marshal of the empire: he bore in the great solemnities of the empire the sword of state, and at the coronation preceded the emperor on horseback.

7. The elector of Brandenburg, arch-chamberlain of the empire: he bore in the coronation-procession the sceptre, and presented to the emperor a basin with water to wash his hands.

8. The elector palatine of the Rhine had the title of the arch-treasurer of the empire: his duties were to scatter at the coronation gold and silver medals, struck for the occasion, amongst the people. This electorate became united with that of Bavaria by the accession of the elector to the throne of the last-named principality in 1777, after the extinction of the reigning house of Bavaria.

9. The elector of Brunswick-Lüneburg, or Hanover, created by the Emperor Leopold I. in 1692, received in 1706 the title of arch-treasurer; when the emperor, having put to the ban of the empire the elector of Bavaria, took from him the office of the arch-carver, and bestowed it on the elector palatine of the Rhine, whose office on that occasion was given to Hanover.

The Second College consisted of the princes of the empire, who were in rank next to the electors: they had each a vote in the diet of the empire, and were divided into Spiritual and Temporal princes.

The Spiritual princes of the empire who had a vote in the diet were:—the archbishop of Salzburg, and formerly the archbishop of Besançon; the grand-master of the German order; the bishops of Bamberg, Würzburg, Worms, Eichstaedt, Spires, Strasburg, Constance, Augsburg, Hildesheim, Paderborn, Freysingen, Passau, Ratisbon, Trent, Brixen, Basil, Münster, Osnabrück, Liege, Chur, Fulda, Lubeck; the princely (gefürstete) abbot of Kempten; the princely prebendaries of Berchtolsgaden and Weissenburg; the princely abbots of Prüm, Stablo, and Corvey.

The Temporal princes were:—the archduke of Austria; the dukes of Burgundy, Magdeburg; the counts palatine of Lautern, Simmern, and Neuburg; of Deuxponts (Zweibrücken), of Veldenz, and Lautereken; the dukes of Bremen, of Saxen-Weymar, Eisenach-Gotha, Altenburg, Coburg; the margraves of Brandenburg-Culmbach, and of Brandenburg-Onolzbach; the dukes of Brunswick, Zell, Grubenhagen, Calenberg, and Wolfenbüttel; the prince of Halberstadt; the dukes of Upper and Lower Pomerania; of Verden, Mecklenburg-Schwerin, Mecklenburg-Gustrow (afterwards Strelitz); of Wirtemberg; the landgraves of Hessen-Cassel and Hessen-Darmstadt; the margraves of Baden-Baden, Baden-Durlach, and Baden-Hochberg; the dukes of Holstein, Gottorp, of Saxe-Lauenburg; the prince of Minden; the landgrave of Leuchtenberg; the prince of Anhalt; the princely count of Henneberg; the princes of Schwerin, Kamin, Ratzeburg, and Hersfeldt; the princely count of Montbeliard. The princes enumerated belonged to the old body; the following, who were elevated to their dignities after the time of the Emperor Ferdinand II., were called the new:—the duke of Aremberg; the princes of Hohenzollern, Salm, Lobkowitz, Dietrichstein, Nassau-Hadamar, Nassau-Dillenburg, Auersberg, East Friesland, Schwarzenberg, Lichtenstein, Thurn-Taxis, and Schwarzburg. Many of these principalities were in the possession of one individual, who had consequently several votes, the votes being attached to the states and not to individuals.

The prelates, abbots, and abbesses of the empire were divided into two benches, the Suabian and the Rhenish, of which each had one vote. The counts and nobles of the empire were divided into four benches; of Suabia, Franconia, Westphalia, and of Wetterau, each having one vote. They belonged to the second college.

The free Imperial cities formed a college at the diet, divided into two benches, the Rhenish with fourteen cities, and the Suabian with thirty-seven. Each town had a vote.

The above-mentioned three colleges formed the diet of the empire, whose ordinary meetings were formerly summoned by the emperors twice a-year, in addition to extraordinary meetings. But from the year 1663 the diet sat at Ratisbon. The emperor at first appeared personally at the diet, but in course of time he sent a delegate, called Principal Commissiarius, who was always himself a prince of the empire, and who had an assistant, called Con-commissiarius. The elector of Mainz, as arch-chancellor for Germany, or his deputy, presided in the diet, and every despatch addressed to the diet was directed to him, and communicated from his chancery to the members of the diet. The president of the first college was the elector of Mainz; of the second, alternately, the archbishop of Salzburg and the arch-duke of Austria; and of the third, the representative of the town where the diet was held. Every college voted separately; and when their respective decisions on the subject under discussion agreed, the matter was presented for the ratification of the emperor; after which it became law, and was called *conclusum imperii*. The emperor could refuse his ratification, but could not modify the decisions of the diet.

The diet had the right of enacting, abolishing, and interpreting laws; of declaring war; concluding peace; contracting alliances; receiving foreign ambassadors, &c. A declaration of war was decided, on an Imperial proposition, by a majority of votes; and when it was decided, even those states that had voted against it were obliged to furnish their contingents. The diet also imposed taxes for the eneral expenses of the empire.

There were two tribunals for the decision of points in dispute between the members of the empire; the Aulic council of the empire, which had its seat always at the residence of the emperor; and the Cameral tribunal of the empire (Cameralgericht), which sat at Wetzlar. They were composed of members delegated by the different states of the empire, and an imperial deputy presided.

The emperor was elected only by the electors, who could do it either personally or by deputies. The place of election was Frankfort on the Main, where the coronation also took place, although the golden bull of Charles IV. declared that the emperor should be elected at Frankfort, but crowned at Aix-la-Chapelle. All strangers, even the princes of the empire and foreign ambassadors, were obliged to leave the town on the day of the election, which took place in a chapel of St. Bartholomew's Church. Mainz was the teller; and after having collected the votes, gave his own to Saxony. The emperor, immediately after the election, swore to the constitution, or, as it was legally termed, capitulation. He could do it either personally or by deputy.

The immediate nobility of the empire, who acknowledge no other sovereign than the emperor himself, and who, as we have mentioned, had their collective votes in the diets, were also judged by the two above-mentioned courts of justice.

German Language and Literature.—The German or Teutonic language may be divided into two great branches, which are subdivided into several dialects: the High German, or the language of Southern Germany; and the Low German, or Saxon, which is used in the northern part of that country.

The High German was formerly divided into two dia-

lects, the Francic and the Allemannic. The Francic was the idiom of the Franks and that of the French court till the reign of Charles the Bald, when it was replaced by the French. The principal monuments of this dialect are, the fragments of a treatise of Isidore, *De Nativitate Christi*, which date from the beginning of the eighth century, and some fragments of the poem of Hildebrand and Hadubrand, which belong to the end of the same century, as well as the oath of Charles the Bald. [FRENCH LITERATURE.] It was used at the court of the German emperors till the accession of the Hohenstauffen. The Allemannic dialect prevailed in the south-western part of Germany, including a great part of Switzerland. Its most antient monuments are—a translation of the rules of St. Benedict, made about the beginning of the eighth century; the poetical paraphrase of the gospels by Ottfried, and a translation of Psalms by a monk called Noker, made about the beginning of the tenth century. Both the abovementioned dialects seem to have disappeared in the middle ages and to have been replaced by the Suabian dialect, which became the language of the court under the Hohenstauffen dynasty, and in which the Minnesingers composed their poems.

The modern German, also called High German (Hoch Deutsch), may be considered as chiefly derived from the old High German, or southern dialect. Its universal usage as the literary language of all Germany dates from Luther's translation of the Bible, by which circumstance it acquired a decided superiority over all the dialects of Germany.

The written language of modern Germany must however be distinguished from that which is only spoken. The spoken language may be divided into the following dialects: 1, the Swiss, which is spoken in German Switzerland, and which itself may be subdivided into several dialects· as for instance, that of Berne and Argau; that of the valley of Hasli; of Freiburg; of the Grisons; and of Appenzel; 2, the Rhenish dialect, which is likewise subdivided into many dialects, as that of Alsatia, of Suabia, &c.; 3, the Danubian, subdivided into the Bavarian, Austrian, and Tyrolese dialects.

The Saxon, that is, the language of Northern or Lower Germany, may be divided into the following dialects: 1, the old Low German (Alt Nieder Deutsch), called also the old Saxon, from the nation that spoke it. This language, which is now entirely extinct, was spoken at an early period, and during a part of the middle ages in all the north of Germany as well as in the Low Countries, except the parts inhabited by the Frisians and the Angles. The works written in this language were composed from the eighth to the eleventh century: the principal of them is the *Evangelien Harmony*, which seems to date from the beginning of the ninth century; 2, the Low German of the middle ages, which was in use from the eleventh to the sixteenth century, contains many works, but its literature is very inferior to that of the Suabian, or the High German of the middle ages. The chief productions in that dialect are: a Vocabulary composed in the twelfth century; a translation of the Bible, made at the beginning of the thirteenth; and the well known comic productions 'Reineke der Fuchs' and 'Til Eulenspiegel; 3, the modern Low German, which is spoken over almost all Northern Germany, but has ceased to be a written language. Its literature is very poor, and contains, besides popular songs, only some grammars, vocabularies, and a few chronicles, of which the principal is that of Livonia by Russow. This language, which is subdivided into many dialects, is distinguished by the softness of its sounds, and has fewer gutturals and accumulated hissing consonants than the High German dialects. It is poorer in grammatical forms than the above-mentioned dialects, but it contains more roots. The Low German is divided into three principal dialects: 1, the Saxon proper, or the idiom of Lower Saxony, which is subdivided into the dialects of Hamburg, Holstein, Schleswig, Hanover, &c.; 2, the Oriental Saxon, which is also subdivided into the idioms of Higher Saxony, Brandenburg, Pomerania; 3, the Occidental Saxon, or Westphalian, which is also subdivided into several dialects.

The Frisian language is a branch of the German tongue. It may be divided into three dialects: 1, the Batavo-Frisian, which very much resembles the Anglo-Saxon, and which was formerly spoken in many parts of the north of Holland, but is now preserved only in a few places about the towns of Moleweren and Hindelopen in West Friesland; 2, the Westphalian Frisian, which was spoken in many parts of Westphalia, but is now entirely extinct and replaced by the Saxon; 3, the Northern Frisian, which still exists on the island of Heligoland as well as in some parts of Schleswig, where Frisian settlers established themselves in the middle ages. The Frisian literature is very poor.

The Anglo-Saxon language is treated in a separate article. [SAXON LANGUAGE.] The Dutch and Flemish are spoken of in the article NETHERLANDS. The Scandinavian languages are also a branch of the German tongue.

Those who wish to study the history of the Teutonic languages will find ample information in the learned works of the two brothers Grimm, which have been republished several times in Germany.

The most antient monument of German literature extant is the translation of the Bible into the Gothic language by Bishop Ulfilas. It was made in the second part of the fourth century, for the use of the Gothic tribe of the Thervingians, who, having settled on the banks of the Danube, in the antient Roman province of Mœsia, were generally called Mœso-Goths. Ulfilas on that occasion introduced a new alphabet by modifying the old Runic characters, which were in general use amongst the Teutonic nations. The library of Upsal in Sweden possesses a remarkable fragment of this translation, well known under the name of the *Codex Argenteus*, being written in silver letters on a purple-coloured parchment. It contains the four gospels, and is supposed to have been written in the fifth or at least in the beginning of the sixth century, among the Goths of Italy. Some fragments of St. Paul's epistles to the Romans were discovered on a palimpsest in the library of Wolfenbüttel; and several parts of the books of Esdras and Nehemiah, as well as several epistles of St. Paul, preserved in the same manner, were discovered in the library of Milan by Angelo Mai. Several editions of those fragments, accompanied by interesting commentaries, have been lately published in Germany.

First period: from Charlemagne to the Accession of the Suabian dynasty.—The reign of Charlemagne may be considered as the commencement of the German literature, although there are some fragments of translations from ecclesiastical books which were probably made prior to that epoch. Charlemagne, who was very anxious to promote the cultivation of his native language, introduced German names of months. He ordered the scattered monuments of the Teutonic language, particularly laws or customs, and songs, to be collected. He also ordered the ministers of religion to preach in German, and directed the translation of several things from the Latin for the information of the common people. He also wished to have a German grammar made, but this important object seems not to have been effected at that time. It is impossible to know whether the songs collected by the order of Charlemagne were of the same kind as those which, according to the description of Tacitus, were in use amongst the Germans about the beginning of our æra, or to form any correct idea of them, as the collection is entirely lost. The two most antient German poems are, the 'Lay of Hildebrand and Hadubrand,' and the 'Prayer of Weiszenbrun,' which have been published by Grimm, and which belong to the eighth century.

After the reign of Charlemagne, the Christian religion being established throughout all Germany, many fragments of the Bible and some ecclesiastical writings were paraphrased from the Latin into the vulgar tongue. The separation of the Germanic empire from the French, which took place in the middle of the ninth century, acted beneficially on the national language and literature. The earliest known German poem of that time is a song written in commemoration of the victory which Louis III. of France gained over the Normans in 881. Another curious monument of the literature of that time is the laudatory poem on Saint Anno, archbishop of Cologne and tutor of the Emperor Henry IV. But the most remarkable production is the metrical paraphrase of the gospels by Ottfried, a Benedictine monk, made about 870, which shows an uncommon poetical genius in the author, who had to contend with all the difficulties presented by a rude and uncultivated language. To this period belong also the chroniclers Wittikind, Dithmar, Lambert, and Bruno, who all wrote in Latin.

Second period: from the Accession of the Suabian Dynasty to the Reformation of Luther, 1137-1517.—The reign of the emperors of the Suabian family of Hohenstauffen is the golden age of the romantic or chivalrous poetry of Ger

many. This poetry being written in the Suabian dialect, which came into fashion through the influence of the reigning family, is generally called the Suabian. Germany at that time had made great progress in civilization, particularly by its frequent intercourse with Italy, which was owing to the expeditions of the emperors to that country. This circumstance led to an acquaintance with the Troubadours of Provence; and the Crusades also, which brought the Germans into contact with more civilized nations, such as the Greeks and the Saracens, powerfully contributed to advance the intellectual development of the nation, and to exalt their chivalrous spirit. The poets of that period are known under the name of Minnesingers, from the old German word *minne*, which signifies 'love.' They may be compared in many respects with the Troubadours of Provence, and were generally knights and nobles, whose life was divided between the occupations of love, war, and devotion, which inspired their poetical effusions with tender, noble, and pious feelings. They lived chiefly at the courts of German princes, who were fond of poetry, and many of whom were poets themselves. Such were, among others, the Emperor Frederick II., Leopold IV., duke of Austria, Henry margrave of Misnia, Herman margrave of Thuringia, &c. The court life, which was spent amidst tournaments and splendid entertainments of every kind, gave to their poetry a high degree of refinement and brilliancy. Love and the praise of ladies were the principal themes of their compositions, in which however were intermingled the description of chivalrous exploits generally performed either in defence of religion or for the honour of the fair. Most of these poems are original and written on national subjects. There are many however which are imitations from the Troubadours. The versification of these poems is exceedingly varied, and they were generally set to music and sung by their authors. The most antient Minnesinger whose works have reached us is Henry Von Veldek; next to him the most celebrated are Walter von der Vogelweyde, Reimar the Old, Reimar von Zweter, Ulrich von Lichtenstein, Wolfram von Eshenbach, Hartman von der Aue, and some others, who all lived either at the end of the twelfth or at the beginning of the thirteenth century. The last of these poets who deserve notice are John of Würzberg and John Hadloup, who both lived at the end of the thirteenth century.

The best and most complete collection of the small poems of this period, which contains between 1400 and 1500 songs, the labour of 140 poets, was made in the fourteenth century by Rüdiger Von Manesse, Burgomaster of Zürich, and published by Bodmer and Breitinger, in ten volumes quarto, 1758-59, at Zürich.

The most remarkable production of that time is the celebrated 'Nibelungen Lied,' which is quite different from the poems of the Minnesingers, and whose origin is by many ascribed to a much more remote period. It is a kind of epic poem, of which the chief heroes are Attila, or Etzel, king of the Huns, and Dietrich, or Thedoric, of Berne, king of the Goths. There are several minor poems of the same kind and on similar subjects, which were collected and published for the first time in 1490, under the title of 'Heldenbuch,' or heroic book. This collection has been reprinted several times in the old language, and also translated into modern German. The decline of chivalry put an end to the Minnesingers, and the art of poetry descended from the nobles to the burgers of cities; welfare and civilization being secured by their fortified towns, gave them a decided advantage over the nobles, who abandoned themselves to the greatest excesses, and lived in a most lawless state, being constantly engaged in mutual feuds and depredations during the troubles which agitated the German empire in the latter part of the 13th century, after the death of Frederic II.

The cultivation of poetry by the burgers became a kind of trade, and the poets, who formed a corporation like other artisans and tradesmen, were called Meistersingers, or master singers. They had their rules like other corporations, and the members were obliged to submit to an apprenticeship. Their poetry was of a different kind from that of the Minnesingers. The exploits of chivalry and the enthusiastic love or rather worship of ladies were no longer the exclusive themes of their compositions, although they produced some metrical chronicles. The general subjects of the poems of this period are of a moral and satirical character, but there are also some of the didactic kind. The most celebrated productions of this school are the well-known poems, 'Reinecke Der Fuchs,' translated into English, and published for the first time under the following title:—'The History of Reynart the Foxe, by me William Caxton, translated from the Dutch into English, in Thabbey of Westmestre,' 1481, folio, which has been frequently reprinted; and the 'Narrenschiff,' which has also been translated (not from the German original, but from a Latin translation, entitled 'Stultifera Navis') into English under the title of the 'Shippe of Fooles,' by Alexander Barclay.

There are many other productions of a similar kind, all characterized by an overflowing comic and satirical humour. The best specimen of this national humour is the celebrated production called 'Eulenspiegel,' translated into English under the title of 'Owleglass,' London, 1709.

To this epoch belongs the commencement of the original dramatic literature of Germany, which is due to the meistersingers' school of Nürnberg. Before that period the Germans were only acquainted with the so-called mysteries or dramatized biblical stories, written and performed for the most part in Latin. About the middle of the 15th century, Hans Volz, a barber by profession, Rosenblut, and some others, introduced a kind of farce called 'Carnival Plays.' They were all excelled by Hans Sachs, a shoemaker by profession, who lived from 1494 to 1576: his works are full of wit and, invention, and next, to the Spaniard Lope de Vega, he is the most fertile of dramatic writers.

Many historical and allegorical poems were written during the 15th century, and several ballads and other metrical productions were rendered into prose, which may be considered as the commencement of the novel in Germany. Amongst the historical works which belong to this period we may mention the chronicles of Bishop Otho, of Freisingen, and his 'History of Frederick I.'; the works of Henry of Erfurt, who died in 1370; those of Gobelinus, who died about 1420; and some others, all written in Latin. The 'Fürstenbuch, or Book of Princes,' by John Enenkel, 1250; the 'Metrical Chronicle' of Ottokor, of Horneck, born about 1264; the 'Chronicles' of James Von Koenigshofen, of John Rothe, of John Thurmayr (Aventinus); the 'Pomeranian Chronicle,' by Kantzow, and that of Lubeck, by Detmar, were written in German. The 'Chronicle of the World,' by Sebastian Frank, is the first universal history in the German language. Among the scholastic philosophers several Germans distinguished themselves from the beginning of the 13th century; we may quote as one of the most celebrated Albert Grosz, or Grot, better known under the name of Albertus Magnus, who distinguished himself also by a knowledge of natural philosophy superior to that of his contemporaries, and who in many respects may be compared with Roger Bacon. Many collections of laws were also made during this period, of which the most celebrated are the *Sachsenspiegel* and the *Schwabenspiegel*, *i. e.* the Saxon and the Swabian Mirror, both compiled in the 13th century. The invention of the art of printing, of which the Germans are so justly proud, gave a new impulse to literature and prepared the way for the Reformation. We conclude the brief sketch of this period with the names of the following authors who belong to it:—Rudolph Agricola, 1443-85, professor at the university of Heidelberg; and Conrad Celtes, 1459-1508. Reuchlin, Ulaic Von Hutten, and Camerarius, form a link between this and the following period.

Third period: from the beginning of the Reformation, 1517, to the present day.—The Reformation of Luther gave an extraordinary impulse to the national literature of Germany, and Luther himself contributed more than any other man to the advancement of the German language, which may be considered as having been fixed by his translation of the Scriptures. The religious quarrels which agitated Germany during the sixteenth century gave to literature a theological direction, and the first scholars of that time were more or less engaged in religious controversy. Among the poets we may mention Luther himself, who composed many religious songs; Rudolph, Weckherlin, and, above all, Opitz, the founder of the so-called Silesian school.

Opitz (1597—1639) greatly improved the style of German poetry by imitating the classics. The German language is indebted to him for more correctness and harmony, but particularly for having purified it from the barbarisms with which it had been loaded. Among the principal followers of Opitz, who form the Silesian school, we may mention — Paul Flemming, 1609—40; Simeon Dach, 1605—59; A. Tcherning, 1611—59; Paul Gerhard,

1606—76; F. Van Logau, 1604—55; A. Gryphius, 1616—64; and John Rist, 1607—61. Many literary societies, whose object was to promote the national literature, were formed in the seventeenth century; the most remarkable were the Order of Flowers, established in 1044, and the Fructifying Society, established in 1617, by Louis, prince of Anhalt.

The German poetry of the seventeenth century is however very deficient in real merit, and except some religious songs there is scarcely any poetical production which can be read at present. The general characteristics of the poetry of this period are ridiculous bombast and affected mannerism introduced by some imitators of the Italian poetry of Marino's school.

Among the prose writers we must mention in the first place the mystical authors, or the so-called theosophists, who united the study of divinity and metaphysics with that of natural philosophy. The most celebrated are Paracelsus, well known as a physician and chemist; and Weigel, a Saxon clergyman, who may be considered as the pupil of Paracelsus, having imbibed his doctrines from the works of his master, and adapted them to divinity and ethics. To the same school belongs Jacob Boehme.

The best historical works of this period are the Magdeburg 'Centuriæ,' an ecclesiastical history written in Latin, in order to prove the concordance of the Protestant doctrines with those of the primitive church. It derives its title from being divided into centuries, of which one is contained in each volume. Steidanus wrote a 'Universal History,' in Latin; and Carrion composed a 'Chronicle' in German, about the middle of the sixteenth century. There are very few historical writers in this period: and we may conclude this notice by mentioning Puffendorf, who, besides his treatises on international law, wrote several historical works; and Herman Conring, who wrote on several historical and biographical subjects. Both these writers belong to the seventeenth century.

In the natural sciences the first place belongs to Conrad Gesner (born in 1516), who, on account of his great knowledge in all the branches of natural history, was named the German Pliny. In the sixteenth century Otto Guerike acquired a justly merited reputation by his invention of the air-pump.

To this period belong Kepler; Leibnitz, who however often preferred writing in French; and the learned Wolf.

Gottsched (1700—66) did a great deal towards purifying the German language and fixing its grammatical rules but he was too servile an imitator of the classics and of the French authors; and his excessive strictness in adhering to the rules laid down by the great literary authorities of antient and modern times led him into an absurd pedantry. Gellert (1715—69) introduced a better taste into German literature, particularly by his fables and tales, as well as his lectures on poetry and eloquence. Lessing (1729 81) powerfully contributed to the reformation of German literature by his criticisms as well as by his literary compositions. Gaertner (1712—91) did a great deal towards improving the taste of his countrymen and banishing many of the prevailing errors which obstructed the improvement of the literature of Germany. Rabener, who is well known for his satirical compositions, laboured towards the same end by attacking the pedantry and the assumption of some writers.

We shall here briefly enumerate the principal authors, beginning with the poets who have appeared in Germany since the middle of the last century, and at the same time give a rapid survey of their works, following the alphabetical order.

Charles Gustave Brinkman was born in 1764, in Sweden, but educated in Germany, where he afterwards spent a great part of his life in a diplomatic capacity. He published several poems in German, which are distinguished by great purity and harmony of language.

Bürger is the well-known author of Eleanora and other ballads. Claudius Mathius (1743—1815) wrote, under the name of Asmus, or 'the messenger of Wandsbeck,' numerous songs, ballads, elegies, and fables, characterized by practical good sense, wit, and humour, which gave them a universal popularity among all classes. The tendency of his writings is always moral, and calculated to promote religion, patriotism, and all the virtues, while he mercilessly lashes folly and vice. The productions of the latter part of his life show a strong tendency to mysticism, and are entirely opposed to the spirit of his early writings. His collected works were published in 8 volumes. Many of his songs were set to music, and are known over all Germany. John Andrew Cramer, chancellor of the university of Kiel (1723—88), wrote many lyric poems; his religious odes and hymns are the best. Michael Denis (1729—1800), a celebrated bibliographer, translated Ossian into hexameters, and wrote several poems in the stylo of Ossian, which he published under the name of the 'Poems of the antient German bards.'

Gessner, Solomon. [GESSNER, SOLOMON.]

J. W. L. Gleim (1719—1803), who is considered one of the best German poets of his time, distinguished himself, particularly by his fables, tales, epigrams, and songs for children. His collected works, in 8 volumes, have passed through several editions.

Göcking (1748—1828) wrote songs, allegorical poems, and epistles, but his reputation was chiefly established by the 'Songs of two Lovers,' which first appeared in 1777. They attracted the general attention of the German public, and were warmly eulogised by the best critics.

Goethe. [GOETHE.]

Gotter (1746-97) wrote tragedies, comedies, operas, epistles, tales, songs, &c, His works are distinguished by great perfection in their construction, but display no superior poetical genius.

J. N. Götz (1721-81) wrote with considerable success odes, elegies, idylls or eclogues, tales, and allegorical poems, which are characterised by great elegance, ease, and brilliancy.

Frederick Hagedorn (1708-54) acquired celebrity by his fables, tales, merry songs, and several minor poems. He may be considered as the first German poet who succeeded in this style of composition.

Haller, the celebrated physician and naturalist, wrote also many elegiac and didactic poems.

Herder. [HERDER.]

Hippel (1741—1796) is considered the first of the humorous writers of Germany. His works are rendered exceedingly attractive by the shrewd observations and thorough knowledge of human nature which the author displays, particularly in representing some well-known contemporary characters. He was most successful in satire, but his comedies, religious hymns, eclogues, and other poetical compositions, are by no means devoid of merit. His life and character were full of singularities, and exhibited the most striking contrasts. Unlike the generality of poets, he left at his death 140,000 dollars, although he began his career with scarcely any fortune.

Hölty (1748-76) is considered one of the best lyric poets of Germany, and his poems, particularly his idylls and elegies, are very popular in that country.

Anna Louisa Karsch (1722—1791), the daughter of a publican, who was married successively to a weaver and to a tailor, spent a great part of her life in struggling against the greatest misery, until she found some benevolent patron. She enjoyed for some time considerable reputation, but her poems are now nearly forgotten.

Kästner, a celebrated mathematician (1719—1800), was also known by his witty epigrams.

Ewald Kliest was born in 1731, and fell in battle in 1759. He wrote several poems, of which his 'Spring' acquired at once a universal popularity, which it still enjoys.

Klopstock. [KLOPSTOCK.]

Kosegarten (1758—1818) spent the greatest part of his life as a pastor of a parish, on the island of Rugen, where he devoted to literary pursuits all the time that was left to him from the duties of his avocation. In 1807 he became professor of divinity at the university of Griefswald, where he remained till his death. Besides some novels, he wrote many poems belonging to the so-called romantic school, which have attained considerable reputation in Germany.

Kotzebue. [KOTZEBUE.]

Lichtwer (1719-83) is a popular writer of fables.

Mathisson (1761—1831) was a lyric poet of considerable popularity, whose works are however more distinguished by skilful versification than by poetical genius.

Frederick Müller, known by the name of Painter Müller, was a painter, engraver, and poet (1750—1825). Besides some dramatic productions, he wrote chiefly elegies; his works are distinguished by passionate inspiration, and a successful delineation of character, although they are sometimes wild and incoherent.

Neubeck, a didactic poet, established his reputation by

his poem, entitled 'Mineral Wealth,' written in hexameters.

Baron Nicolay (1737—1820) was born and educated at Strasburg, but spent the greatest part of his life in Russia, where he was invited, in 1769, to superintend the education of the Prince, afterwards the Emperor Paul. He wrote fables, tales, elegies, epistles, and ballads, as well as some dramatic pieces, which were favourably received in Germany.

G. K. Pfeffel (1736—1809), brother of the celebrated political writer of that name, wrote numerous fables and tales, which attained some popularity.

Rammler (1725—98), a lyric poet, translator, and critical author. His works do not display any great poetical genius, but have the merit of extreme correctness, refined taste, and purity of language, and in these respects they may be considered as models. He translated Martial, Catullus, and Horace. Among his original poems the most successful is 'The Death of Jesus,' and some other lyrical productions.

Schiller. [SCHILLER.]

Christian Count Stolberg (1748—1821) wrote several dramatic pieces, and translated into German several of the Greek poets. He was particularly successful in the expression of tender feelings, and in painting domestic scenes. His works were published in twenty volumes at Hamburg, in 1821. His younger brother, Count Frederick Leopold (1750—1819), who far excelled him in poetical talent, is known as a poet by his odes, hymns, elegies, ballads, satires, and dramatic compositions; as a prose writer, by his novel, entitled the 'Island,' and by his travels through Germany, Switzerland, Italy, and Sicily. He acquired also considerable reputation by his translation of Homer; of some dialogues of Plato; and of some tragedies of Æschylus. His poems have a greater boldness of thought and more imagery than those of his brother. All his works are characterised by a glowing enthusiasm for nature, friendship, liberty, and all that is dear to a noble mind. The tone of his productions is very diversified, and ranges from the simple song to the fiery expression of the dithyramb. In his 'Life of Alfred the Great' he displayed an exact knowledge of Anglo-Saxon history. His conversion from the Protestant to the Roman Catholic religion produced a great sensation in Germany, and embroiled him with many of his friends.

Thümmel (1738—1817) gained a reputation by his comic heroic poem, although written in prose, 'Wilhelmina, or the Married Pedant.' He wrote several lyric poems, but his reputation was chiefly established as a prose writer by his 'Travels in the southern provinces of France,' a kind of novel full of wit and humour. The only fault of the work is its extreme length, 10 volumes.

Uz (1720-96) wrote various poems of different kinds, but his epistles, his merry poems, and religious hymns are his best productions.

Voss (1751—1823) is perhaps the best translator of the classical authors into modern languages that has appeared. He translated Homer, Virgil, Ovid, Horace, Hesiod, Aristophanes, Theocritus, Bion, Moschus, Tibullus, and some other minor authors, into German verse. These translations are remarkable for the fidelity with which they express the meaning, and frequently the peculiar character of the original. The difficulty of the undertaking and the author's success are perhaps in no instance better shown than in his happy translation of the most difficult parts of the 'Idylls' of Theocritus. In connexion with his sons Henry and Abraham, he also made a translation of the complete works of Shakspeare. Of his original works the most celebrated is his poem called 'Louisa,' which is a masterpiece in its kind. The subject is a description of the wedding of a country clergyman's daughter; the metre is hexameter and the style an imitation of that of Homer; and yet with these apparent absurdities it contains great beauties and is one of the most popular works in Germany.

Wieland. [WIELAND.]

Zacharia (1726-77) is one of the best comic poets of Germany, and his works are still held in high estimation.

The living writers of Germany defy all enumeration. The 'Pocket-book of Comedians,' published by Lambert (1823) mentions no less than 287 living dramatic writers. This will serve as a specimen of the number of individuals engaged in literary pursuits. It is almost needless to remark that a great mass of worthless books must be produced by such a host of writers. Many however have attained a well-deserved reputation. We shall briefly mention the principal writers, following the same order.

Chamisso was born in France in 1781, but emigrated in his childhood to Germany, where he received his education. He is a man of great information, particularly in the natural sciences. In 1815 he embarked in a voyage round the world as a naturalist to a Russian expedition, and on his return, in 1818, he received a situation at the botanical garden at Berlin, where he still remains. He has written several romances and ballads founded on popular traditions, which have had great success. He is considered one of the most national poets of Germany, although born a Frenchman. Chamisso is the author of the well-known tale of 'Peter Schlemihl,' which has been translated into several languages of Europe, and of which an English edition has appeared with designs by Cruikshank. Besides his works of imagination he has written a volume on his voyage round the world, and a work on the plants of Northern Germany.

Helmina Chezy, the widow of the well-known French Sanscrit scholar of the same name, and daughter of the celebrated German authoress Karsz, is considered by the Germans to be one of their first living poets.

Heine, a poet and political writer, born in 1797, is one of the most popular poets of Germany, and undoubtedly possesses great talents, although his style is full of inequalities, frequently passing from sublimity to vulgarity, and from deep feeling to an extreme frivolity. He has written two tragedies, 'Almansor,' and 'Radcliff,' besides many smaller productions. Amongst his prose works, his travelling sketches have a great popularity in Germany, but although they contain many beautiful descriptions, and witty and shrewd observations, they are often disfigured by great coarseness. Heine lives at Paris: his work on the political state of France has produced a general sensation in Germany.

Löben (Count), born in 1786, died 1815, belongs to the popular writers of Germany; he wrote chiefly ballads and tales.

Platen (Count), born in 1795, besides several dramatic pieces has written many other poems, particularly imitations of Oriental productions, which his great knowledge of the Persian language and literature has enabled him to do with considerable success. He is a general favourite with the public of Germany.

Pyrker is archbishop of Erlau in Hungary, where he was born in 1772. His epic poems entitled 'Pearls of the Holy days of yore,' 'Tunisias,' and 'Rudolfias,' though they cannot claim the merit of being faultless epic poems, contain great poetical beauties and show a very refined taste.

Rückert, better known under his assumed name of Freimund Reimar, born in 1789, is now professor of Oriental languages at the university of Erlangen. He is considered to be one of the best lyric poets that Germany has ever had. Besides a great many original poems he has made many translations from Oriental authors.

Schwab, born in 1792, is, next to Uglana, the most popular writer of romances and ballads.

Schenkendorf (1784—1817) is the author of several religious and patriotic poems which enjoy great popularity, and he would have perhaps become one of the first poets of Germany if his premature death had not cut short his literary career.

Tiedge, born in 1752, who is still living at Dresden, is one of the most popular authors in Germany. His poems are chiefly of the lyrical and didactic kind, and are considered scarcely inferior to those of Rückert. Many of his poems have been set to music by the first composers of Germany. An edition of his complete works was published in 1829, in eight vols.

Tieck, born in 1773, has written several poems, but is much better known by his critical works and by his translations of Don Quixote, several plays of Shakspeare, and of other old English dramatic writers. Tieck has written several humorous tales and dramas; he has published also a collection of poems of the antient Minnesingers, and thus introduced among his countrymen a taste for their antient literature.

Uhland, born in 1787, is one of the best lyric poets of Germany and exceedingly popular. He is also a learned antiquarian, and his work on Walter Von der Vogelweide, a celebrated Minnesinger, and his researches into the northern mythological Sagas of Thor, show a thorough knowledge of his subject.

Zeidlitz (Baron), born in 1790, has established his poetical

reputation by his dramatic and lyric productions. His poems entitled 'Wreaths of the Dead,' published in 1831, have had universal success. They have derived this title from being written in praise of eminent deceased persons. Amongst his dramatic works, published in four volumes, 1836, the best are 'Turturel,' 'Two Nights at Valladolid,' and the 'Star of Seville.' The most remarkable is however the drama entitled the 'Prison and the Crown,' of which the last days of the life of Tasso form the subject. Zeidlitz published, in 1836, a very well executed translation of Byron's 'Childe Harold's Pilgrimage.'

German Prose Writers.—The first historical work of any note that appeared in Germany during the eighteenth century was the translation of the 'Universal History,' published in England by a society of learned men, of whom the principal were Sale, Bower, Swinton, &c. The translation began to appear in German in 1744, at first under the superintendence of Baumgarten, and afterwards under that of Semler. But the imperfections of the original work being soon perceived in Germany, it was found necessary, after the publication of the early volumes, to make numerous corrections, the original being written with little or no historical discrimination and criticism. After the thirty-first volume, the German editors no longer followed the English text, but replaced it with original matter. Thus Schloezer wrote a general Survey of the Northern Countries; Meusel, the History of France; Le Bret, of Italy; Sprengel, of England: Galletti, of Germany; and Rühs, of Sweden. In this way the work increased to 78 large volumes in quarto, but it is not complete. It contains abundant materials for history, and some special parts are written with considerable ability. A translation of the 'Universal History' of Guthrie and Gray was also undertaken in Germany. But the German editors in this case also soon abandoned the English text, and substituted their own work for it. Heyne wrote for this collection the antient Asiatic, Greek, and Roman history, as well as that of the Arabs, Moguls, and Turks; Ritter described the period of the Roman and Byzantine emperors, and that of the first states which were founded by the Germanic nations; Schroekh wrote the history of Italy, France, England, and the Low Countries; Heinrick, the history of the Germans and of the German empire; Dieze, that of Spain and Portugal; Wagner that of Poland and the north of Europe; Gebhardi, Hungary and the countries connected with it. Johann Von Müller begun his history of the Swiss Confederation, with the view of making it a part of this collection, which contains a great deal of valuable matter, but, like its predecessor, the 'Universal History,' must be viewed as a series of special histories rather than as a universal history. Schroekh and Remer published several compendiums of universal history, which are written with considerable care, but they are deficient in those elevated views which constitute a true historian. Beck treated history according to a method peculiar to himself, in his 'Introduction to the Knowledge of Universal History,' a work which has not been completed. Busch wrote, in the style of a chronicler with great impartiality and research, but in a rather dry manner, and in an imperfect style, his 'Outline of the History of the most remarkable Events of Modern Time since 1440.' It was finished after the death of Busch by Bredow, and completed by Hegewisch, who added to it the antient history, and that of the middle ages. The 'Universal History' of Eichhorn enjoys a well-merited reputation, but it is surpassed by his 'History of the three last Centuries.' Heeren's 'Compendium of the History of the States of Antiquity;' of the 'European Political System;' and his 'History of European Colonies since the discovery of both the Indies till the establishment of the imperial dignity in France,' are all works of merit, though it must be admitted not free from objection as to the mode in which he handles his authorities and draws his inferences from them, especially in the first-mentioned work.

Raumer is considered as Heeren's rival by his 'History of Europe since the end of the fifteenth Century,' 4 vols., Leipzig, 1832-34.

The other German works on universal history which deserve mention are 'Sketches of Universal History,' by Dippold, 2 vols., Berlin, 1812; 'Survey of Universal Political History,' by Dresch; and the works of Poelitz, Schneller, Schlosser, Rotteck, and Menzel. The best compendiums of universal history for academic and school use are those of Wachler and Wachsmuth.

The special history of several nations and countries has been treated in Germany of late years with a degree of research, patient industry, and sound judgment, in which the Germans have surpassed all the rest of their European contemporaries. To this class belong Maylath's 'History of Austria, and that of Hungary.' Lappenberg's 'History of England' is only at its commencement, but what has already appeared shows an uncommon acquaintance with the historical sources for the Saxon period of our history. Von Hammer has written a history of the Turks, founded on Oriental authorities; Gejer, of Sweden; Kampen, of the Low Countries; Raumer, the history of the Hohenstauffen dynasty; Luden, Menzel, and Pfister, each a history of the Germans; Voigt, a history of Prussia; and Wilken, a history of the Crusades.

It would be beside our purpose to do more than indicate in a general way the spirit which characterizes the present historical school of Germany. To mention all the writers here would be impossible; but we must not omit to give to the patient industry of the German historians that praise which is justly due. Not only have the complicated events of modern times been subjected to a criticism, searching and minute as to details, and rich in results and general principles, but the same patient investigation has been carried to the study of antiquity. Instead of being a barren and ungrateful pursuit, it has become in the hands of the German philologists a rich and instructive study, peculiarly adapted to form the youthful mind to habits of careful investigation and accurate appreciation of evidence. Of the writers who have laboured in this department, it is enough to mention the names of Niebuhr, Wachsmuth, and K. O. Müller.

The Germans have produced many valuable works on the history of the human mind, on the progressive civilization of the human race, and on the history of literature and art. Adelung's 'Essay on the History of the Civilization of Mankind,' is a work of considerable merit, but is surpassed by Herder's 'Ideas on the Philosophy of the History of Mankind.' Jenist wrote a 'Universal Historical Survey of the Development of the Human Race as a progressive whole,' Berlin, 1801; and Eichhorn a 'General History of the Civilization and Literature of Modern Europe.' The same subject was treated with more or less success by Waltman, Stapfer, Pölitz, and Schneller, &c. Special branches of these subjects have been treated in the following works:—'History of the Origin, Progress, and Decline of Learning in Greece and Rome,' by Meiners; 'History of the Study of Classical Literature since the Revival of Learning in Europe,' by Heeren; but both these works remain incomplete; 'History of Poetry and Eloquence,' by Bouterweck, who likewise published a very valuable 'History of the Literature of Spain;' and other works on the history of literature, by Meusel and Waehler; the latter of whom wrote also a history of historical research and of the sciences. The two Schlegels occupy a distingushed rank as critics. The lectures of A. W. Schlegel on dramatic literature have been frequently referred to in the article Dramatic Literature.. In addition to Mosheim, who wrote, in Latin, ecclesiastical history has been treated by Schroekh, who devoted almost all his life to the composition of his 'Christian Ecclesiastical History,' in 35 vols.; to which must be added its continuation since the Reformation, in 10 vols., of which the two last were written by Tzchirner, 1826, the well-known author of many theological works of a polemical nature: his 'Fall of Paganism' was published after his death in an unfinished state, although he had spent twenty years upon it. 'The Universal History of the Christian Religion and Church,' by Neander, is generally esteemed. The subject of the antient religious systems is treated in Rhode's work 'On the Religious System of the Bactrians, Medes, and Persians;' and in his 'Essay on the Religious Civilization, Mythology, and Philosophy of the Hindoos.' Münter wrote a valuable work on the religion of the Carthaginians. The history of philosophy is treated in the compendiums of Eberhard, Gurlitt, Socher, and Tennemann; and in the extensive works of Tiedemann, Buhle, Tennemann, and H. Ritter. Fisher wrote a history of natural philosophy; Gmelin, of chemistry; Hoyer, of the military science; and Stäudlin, of the theological sciences. But the 'History of Medicine,' by Sprengel, is probably superior in real merit to any other work of the kind.

Geographical science has been most successfully culti-

vated in Germany: indeed we may say that Germany is its birth-place. Antient geography was treated for the first time by Cellarius in his 'Geographia Antiqua,' Leipzig, 1686, which has been since republished many times under the title of 'Notitia Orbis Antiqui.' This work is now no further useful than as showing the progress made since it was written. Among the many German writers on antient geography, the best works are—'Geography of the Greeks and Romans, founded on their Writings,' by Conrad Mannert, 10 vols., Leipzig, 1788-1820—a work of labour and research, valuable as all German works of the kind are for the authorities, but liable to the objection, in common with many other German works, of an inadequate estimation of them. 'The Geography of the Greeks and Romans, from the Earliest Times to Ptolemy,' by Ukert. A valuable contribution to the history of geography is the 'History of the most important Geographical Discoveries to the arrival of the Portuguese at Japan,' by Sprengel. 'The Comparative Dictionary of Antient Geography with that of the Middle Ages and Modern Times,' by Bishoff and Möller, is a very useful book for geographical students. Modern geography was for the first time treated on something like a system by Büsching, whose 'Universal Geography,' in 10 parts, 1754-92, was long considered a standard work. The numerous political changes which have taken place since the time of its publication have rendered it of little use even as a description of political divisions; and physical geography at that time hardly existed. Since the time of Büsching many valuable works on modern geography have appeared in Germany. The 'Universal Geography' of Shütz, in 30 vols., which appeared at Vienna, 1824-33, is a collection of special descriptions of all the countries of the world, by the most eminent writers. The first geographical writer in Germany is Charles Ritter, in Berlin, whose work, 'Geography in its relation to the Nature and History of Man, or Universal Comparative Geography,' is now in course of publication. The labours of Berghaus also demand honourable mention.

The first geographical dictionary in German was published by Hübner, 1740, under the name of the 'Zeitungslexicon,' or Gazetteer. It was however not a mere geographical dictionary, like the English gazetteers, but it contained articles relating to war and politics, which were the common topics of the gazettes. This work has been re-published many times; it appeared for the last time, with all the corrections and additions rendered necessary by the progress of events, in 1828, in 4 vols., at Leipzig. There are several works of a similar character in German: the 'Geographico-Statistical Lexicon' of Hassel; that of Schorch and Ehrman; of Jäger, &c.

Statistics first received a scientific form and method, as well as a name, from Achenwall (born in Poland, 1719), who began to lecture on this subject at the University of Göttingen, in 1749. A great number of German authors have since written on this important department of political knowledge. We may mention as the most distinguished of them, Schlötzr, Meusel, Hassel, Gatterer, Mannert, Sprengel, and several other authors, whom we have already enumerated among the historians and geographers of Germany.

Germany has produced many eminent writers on every branch of jurisprudence. The predominant school in that country is now the historical, which is divided into the Teutonic, chiefly represented by Fr. Ch. Eichhorn (son of the historian whom we have already mentioned), author of the 'Political and Legal History of Germany,' 4 vols., last edit. 1823; and the Roman, whose principal leader is Gustavus Hugo, professor at Göttingen, the author of many valuable works on Roman law. Savigny, perhaps the first of German jurists, is the author of several highly esteemed works, of which the history of the Roman law during the middle ages has appeared in an English translation. His valuable work on the right of possession, 'Das Recht des Besitzes,' Giessen, 1827, is, we believe, little known in this country, though it is undoubtedly one of the most exact analyses of a complicated legal question that has ever appeared. Among the great jurists of Germany, Thibaut of Heidelberg, the author of the 'System des Pandekten Rechts,' holds a distinguished place. Of the authors belonging to the Roman school may be mentioned Gans of Berlin, author of an historical work on the Law of Inheritance, and of some other treatises. Criminal Law has been treated by Feuerbach in a masterly manner, and by Mittelmeyer, Kleinschrod, Konopach, &c. The truly philosophic spirit in which the study of law is prosecuted in Germany as a branch of academic education and of political investigation, forms a striking contrast with the almost total neglect of legal and political studies in the English academic course of instruction.

The Protestant divines of Germany may be divided into three schools: 1, the Orthodox or Supernatural; 2, the Rational; and 3, the Pietist. The Orthodox or Supernaturalists may be subdivided into the decided Supernaturalists, whose religious conviction is entirely founded on the authority of a supernatural revelation, and which is chiefly represented by Tholuck, Hengstenberg, Guericke, Hahn, Harms, Olshausen, and Sartorius: and the Rational Supernaturalists, who found their belief in a supernatural revelation, not on human reason, but on historical authority, admitting human reason as a means to understand it; to this school belong Steudel, Schwarz, and Zöllick. The Rationalists may also be divided into two sections: the Decided Rationalists, who admit no other standard in judging of religious matters than human reason; such are Rohr, Wegsheider, Paulus, Gesenius, Shalthesr, Baumgarten Crusius, and David Schütz; and the Supernatural Rationalists, who admit a supernatural revelation, but consider human reason as the only test by which it ought to be acknowledged; this section is represented by Ammon, Böhme, Hase, and Köster. There are indeed many divines who do not belong either to the supernatural or rational school, but who pretend that there is no real contradiction between these two principles, which they think to conciliate by a philosophical explanation of the orthodox doctrines: there are also shades even in this party.

The Pietists form no separate school as regards doctrine, but belong to the orthodox or supernatural one. They are distinguished by a more strict adherence to religious observances, and greater zeal in all their views for promoting religion. They frequently adopt exaggerated notions about the duties and obligations of a Christian. Their number has lately much increased in Germany. Their views are advocated in several religious periodicals, and the most celebrated author of that party is Jung Stilling. The well-known Madame Krudener was a great promoter of the same party. In connexion with theology, the Germans have prosecuted with unwearied industry the study of the Hebrew, the Arabic, and other Oriental languages. The study of the Sanscrit and of Indian antiquities, which would seem to have peculiar claims on England, have been followed up in Germany with a zeal which ought to put to shame the nation that governs India. It is sufficient here to mention the names of Bopp, A. W. Schlegel, Rosen, Bohlen, and Lassen.

In pure philosophy the names of Kant, Fichte, Schelling, Hegel, and many others, reflect a lustre on their native land. German metaphysics however will scarcely find a numerous class of readers in any other country, and this, mainly owing to two causes; first, the difficulty of mastering the language so as to understand these writers; and secondly, the great extent of their works, which, as they are parts of a system, require to be studied completely. That no man can prosecute the study of the profound thinkers of Germany without deriving great improvement from the intellectual discipline to which he must submit, is undeniable; but a partial acquaintance with them, through the medium of inadequate translations, can only produce a superficial knowledge and a spirit of dogmatism.

In this rapid and imperfect sketch, our object has been, as in the article on French Literature, merely to present some general notions on what is commonly called the literature of the German nation; that in fact which, in every civilized country, gives us the best idea of a nation's character and mode of existence. That the industry and success of the Germans in prosecuting every branch of inquiry which relates to the phænomena of nature, have kept pace with their efforts in literature, hardly needs to be remarked. The prodigious mental energy of this people, as exhibited by the unwearied and apparently inexhaustible activity of the press, is unequalled in any other part of the world. What the men of other countries could do, if they would—if they had time enough, and patience enough, and zeal enough in their several pursuits—is done, and is daily in progress, in Germany. There seem to be two main causes of this mental activity of the Germans. One is, the number of sovereign states into which the country is distributed; and the other, the form of the political institutions. Con-

sequent on the first cause is the number of functionaries required for the various departments of administration, and of universities, schools, and other places of special instruction, where alone the qualifications required in such functionaries can be obtained. In addition then to the number of men constantly training for the functions of administration or for professions, there must be a great number of persons employed in teaching the various branches of knowledge required; and thus employment is given, with moderate salaries, to a larger body of men in proportion to the population than in any other country, while a situation in a university or other public place possesses the advantage of furnishing a man with a competency, though not enough to make him rich. His ambition is confined to his own sphere by the institutions of the country in which he lives, and he must earn distinction in that branch which he has made his business and his choice. The second cause, the want of political liberty, as it is called, in Germany, seems to have a very extensive operation in turning the industry and the thoughts of the Germans to those subjects where investigation is unfettered and the expression of opinion unrestrained. The great number of persons in Germany, who, under the circumstances just mentioned, receive a superior education, will help to explain, in some degree, a circumstance that at first excites some surprise:—we allude to the great number of special works which, from their subjects and the profound manner in which they are handled, would hardly find any readers in this country; so large however is the class of students in Germany who are profoundly versed in special branches of knowledge, that few really valuable works, we believe, on any subject, fail to find purchasers enough to defray, if not the whole, at least a large part of the expense of publication.

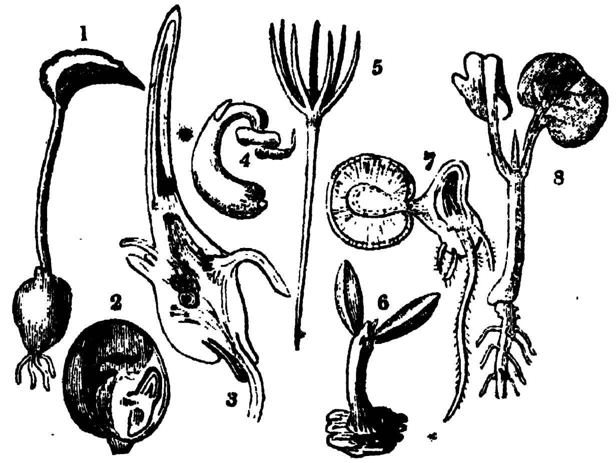
GERMEN, a name applied by the Linnæan school of botanists to what is now called the ovary of a flower.

GERMINATION, the first growth of a seed, the act by which it exchanges the condition of an embryo for that of a young plant. The embryo of a plant is folded up in the inside of a seed, and is either a short double cone on which two or more cotyledons are fixed, or a simple more or less cylindrical body having no apparent distinction between the cotyledons and the axis. [FŒTUS.] It has moreover little other than a cellular organization, very often not possessing a trace of the complicated vascular and tubular structure afterwards developed. The act of unfolding, breaking through the integuments of the seed, and acquiring a vascular and tubular as well as cellular organization, is germination. To bring this about three conditions are requisite: viz., a moderate degree of heat, very variable according to species; moisture; and communication with oxygen. Heat enables the moisture the more readily to dissolve the solid substances contained in the cells of the embryo, and a supply of oxygen provides the means of respiration. This being adjusted, the cells of the embryo dilate, their solid matter becomes fluid, and the carbon they contain combining with the oxygen forms carbonic acid, which is got rid of: the result of this is a diminution of the solidity of the embryo, a formation of sugar in its interior, of which advantage is taken in the process of malting, and a deterioration of the atmosphere. During this period the embryo would naturally be in a state of darkness, and so long as it continues to grow in darkness it parts with carbonic acid; but as soon as the young stems or leaves meet the light, carbonic acid is decomposed, oxygen is liberated, and a green colour is formed. At this period germination is accomplished.

The progress of development in the embryo is usually first for the radicle to lengthen, then for the cotyledons to unfold, and then for the plumule to extend into a stem (*fig.* 8); but in Endogens, the plumule of which is often enclosed in the very substance of the cotyledon, a somewhat different process takes place.

In Potamogeton lucens (*fig.* 4) the radicle gradually swells and lengthens, and at last produces from within its apex a papilla which becomes the root; the cotyledon, which is spiral, at the same time lengthens, and at last the plumule pierces through one side of the embryo. In Canna Indica (*fig.* 7) the cotyledon always remains inclosed in the albumen, merely swelling; the radicle and cauliculus are protruded from the seeds; the former turns downwards and emits a number of fine roots, the latter produces from within its substance a conical body, consisting of several sheaths one within the other, which are the rudiments of leaves. The Cocoa-nut differs from Canna chiefly in its cotyledon swelling exceedingly and becoming spongy, filling the whole cavity of the seed, and absorbing the milky fluid. Grasses offer only a slight modification of the same form. The embryo of maize, when divided vertically (*fig.* 2), appears like a fleshy plate lying on one side of the flowery albumen; at its back next the albumen is the cotyledon, next the skin is a cone of sheaths (as in Canna) forming the plumule, and at the base of the plumule another cone constituting the radicle. When such an embryo germinates, the radicular cone pierces the soil, emitting from its interior, through a kind of sheath, a few slender roots, and protruding others from its surface; and the other cone, representing the plumule, at the same time lengthens upwards in the form of a green spire, leaving the original external part of the sheath at its base (*fig.* 3).

Many anomalies in the development of the embryo of both Exogens and Endogens might be pointed out, but they are of little interest to any but professional botanists. Among the most striking are the following:—In the genus Pinus the cotyledons are numerous, and placed in a whorl (*fig.* 5); in the Cyclamen the cauliculus enlarges into a roundish turnip-like mass, from the apex of which spring the leaves and flowers, and from the base the roots (*fig.* 1); in mistletoe, a parasitical plant (*fig.* 6), the radicle becomes a flat plate, concave on the underside, by which it adheres to the bark of the plant it grows upon, and from which the singular roots proceed, which eventually insinuate themselves through the bark between the plates of living wood.



The manner in which the radicle protrudes itself is different in Exogens and Endogens. In the former its point gradually lengthens and becomes a new root; this is called *exorhizal* germination: in the latter the point of the radicle opens and allows the true root to escape from within it, a phænomenon to which the term *endorhizal* is applied. It will be obvious to those who have read what has been said under FŒTUS, that these differences depend entirely upon the manner in which the cotyledon is rolled round the axis of growth in Endogens, or distinguished from it in Exogens.

Attempts have been made to expedite the process of germination by steeping seeds in a weak solution of chlorine, but no practical advantage has been derived from the experiment. A more effectual plan has been found for hard-shelled seeds, such as those of the Acacia, namely, boiling the seeds for a period between one and five minutes. This has certainly, in some cases, had the effect of causing seeds to grow which under ordinary circumstances would not have grown; a circumstance to be ascribed, we conceive, to the hard integuments of the seed being so much softened as to offer no great resistance to the attempts of the embryo to escape from within them,—attempts which required no assistance when the embryo was in full activity and the seed-coat comparatively soft, but indispensable when these conditions are reversed by the loss of vigour in the embryo and the excessive induration of the case containing it.

GERONA. [CATALONIA.]

GERS, a department in the south of France, situated between 43° 16′ and 44° 5′ N. lat. and 1° 12′ E. and 0° 18′ W. long. It is bounded on the north by the department of Lot et Garonne; on the north-east by that of Tarn et Garonne; on the east and south-east by that of Haute Garonne; on the south by that of Hautes Pyrénées; on the south-west, for a short distance, by that of Basses Pyrénées; and on the west and north-west by that of Landes. The

form of the department is very compact: its greatest length, from east to west, is seventy-three miles; it greatest breadth, at right angles to the length, fifty-three miles: the area is computed at 2424 square miles, a trifle above the average of the French departments, and rather more than the conjoint area of the English counties of Chester and Salop. The population in 1831–32 was 312,160; in 1836, 312,882; this last calculation gives 129 inhabitants to a square mile, which is considerably below the average relative population of France, and very far below the relative population of the English counties compared with it. Auch, the capital, is on the Gers, in 43° 39′ N. lat. and 0° 35′ E. long., about 370 miles in a straight line south by west of Paris, or 479 miles by the road through Orléans, Limoges, Cahors, Montauban, and Toulouse.

Surface, Hydrography, Communications.—The surface of the department slopes gradually from south to north, and is traversed by several branches of the Pyrenees, which follow the same direction and become lower as they approach the northern limits of the department. None of them are much above 1200 feet in height. The most important of these branches is that which separates the basin of the Adour from that of the Garonne. The streams east of this branch flow either to the north or the north-east, into the Garonne, no part of which stream is in the department: the principal are the Bayse, and its tributary, the Losse; the Gers, the Rabs, the Gimone, and the Save. The streams west of the branch of the Pyrenees are, the Douze, the Midou, and the Arros, which have a north-west course, and belong to the system of the Adour; the Adour itself flows for a short distance through the department. None of the rivers in the department are navigable; nor is there water conveyance of any kind. There are eight *Routes Royales* (government roads), having an aggregate length of 258 miles, but not a mile and a half is in proper repair: the *Routes Départementales* (roads under the charge of the local administration) are seventeen in number, and have an aggregate length of 324 miles; four-fifths of these are in good repair. The *Chemins vicinaux* (bye roads and paths) are estimated at 6000, and are in length above 6000 miles. Of the government roads, one of the second class leads from Agen (Lot et Garonne) by Lectoure, Fleurance, Auch, Mirande, and Miélan to Tarbes and Barèges (Hautes Pyrénées); most of the others lead from Auch to different parts of the department.

Geological Character.—The supercretaceous strata occupy the whole department. No metals are found; but there are gypsum, potters' clay, brick earth, fullers' earth, and a fusible spar, used in the manufacture of glass; there are a few mineral springs.

Climate, Soil, Agricultural Produce, &c.—The climate is temperate and salubrious; frosts are of short duration, and snow is rare. The winds are variable; the south-east, south-west, and west predominate. Fogs are not unfrequent in May and June, and are considered injurious to the harvests.

The soil is of middling quality, and does not produce very abundant harvests. It is thus appropriated:—arable, 823,870 acres; meadows and grass land, 150,321; vineyards, 216,775; woods, 146,397; orchards, nurseries, and gardens, 15,065; osier-beds, willow-plots, &c., 642; variously occupied, 50,958; heaths, commons, &c., 88,197; pools, ponds, and ditches, 575; lakes, rivers, and brooks, 5641; forests and other non-productive lands, 3594; unascertained, 45,011: total, 1,547,046 acres.

The arable land is chiefly devoted to the growing of wheat; the quantity that is raised is very great; maize is grown to a considerable extent, also oats, rye, and pulse; some barley is grown, but this grain is not much cultivated in the south of France; potatoes are grown to a greater extent than in most of the southern departments, and cabbages and onions are grown on a large scale. The vineyards, though numerous, do not, with few exceptions, produce good wine; the produce of the vintage is chiefly converted into brandy, known as Armagnac brandy, and ranking next to that of Cognac in excellence. In the pastures are reared horned cattle, many sheep, a few horses, and a considerable number of asses and mules. An abundance of poultry is reared, especially ducks; the legs and wings of these are salted, and form an important store of provisions for the inhabitants, and their livers, which are of great size, make excellent pies. Game and wild animals (as the wolf and fox) are rare. There are few fish in the rivers, but more in the standing waters.

Divisions, Towns, &c.—The department comprehends a portion of Haut or Blanc Armagnac, the whole of Fezenzac, Fezenzaquet, Gaue, and Noir Armagnac, and portions of Eauzan, Riviere Basse, Brullois, Lomagne, Les Baronnies, Astarac, and the county of Ile-Jourdain: all these were subdivisions of the county of Armagnac. A considerable portion of Condomois, and a smaller portion of Comminges are also included in the department. Armagnac, Condomois, and Comminges, were all subdivisions of Gascogne.

The department is subdivided into five arrondissements, as follows:—

Capital.	Population in 1831	1836.	Situation.	Area. sq. miles.	Pop. of Arrondis. 1831.	1836.
Auch,	9,801	10,461	Central.	497	61,645	61,214
Lectouré,	6,495	6,355	N.E.	38[illegible]	53,641	52,605
Mirande,	2,532	2,532	S.W.	665	84,843	85,385
Condom,	7,144	7,098	N.W.	574	71,487	71,855
Lombez,	1,541	1,622	S.E.	306	40,544	41,823
				2,424	312,160	312,882

The department comprehends 29 cantons, and 498 communes.

In the arrondissement of Auch, besides the capital [AUCH] on the Gers, are Vic-Fezenzac, otherwise Vic-sur-Losse (population, 2574 town, 3679 commune) on the Losse; Pavie and Seissan, on the Gers; Castlenau-Barbarans and Aubiet, on the Rals; Sarramont and Gimont (pop. 2094 town, 2952 commune), on the Gimone; Barran, Biran, Jegun, Lavardens, Montant, and Pessan: none of these are of any importance.

In the arrondissement of Lectoure, are the capital Lectoure, near the Gers, Montastruc, Fleurance, and Casteras, on the same river: Mauvesin, Tournecoupe, and St. Clar, on the Rals; Solomiac, near the Gimone; Ligardes, Terraube, Le Mas, La Sauvetat, Cézan, St. Avit, Miradoux, Plieux, Montfort, Gaudonville, and Sarrant or Sarran. Lectoure, situated on an eminence, is an old and ill built town; but one of its *places* commands an extensive and magnificent prospect. A marble statue has been erected in the town to the memory of Lannes, duke of Montebello, who fell in the battle of Essling, A.D. 1809. The inhabitants manufacture leather, and carry on a considerable trade in corn, cattle, wine, and brandy. There are a subordinate court of justice, an hospital, a high-school, and an agricultural society. This town existed in the time of the Romans under the name of Lactora, and was the capital of the Lectorates or Lactorates, an Aquitanian tribe. In the third century after Christ Lactora was a Roman colony. Many Roman antiquities have been found here. In the Middle Age Lectoure was strongly fortified with a triple wall (of which there are some remains) and a castle. It was in the possession of the counts of Armagnac, who often resided here. Jean V., the last count, whose unbridled licentiousness and violence involved him in disputes both with Charles VII. and Louis XI., was besieged in Lectoure by the troops of the latter, and assassinated soon after the surrender of the town. At Fleurance is a fine market-place, in which are held eight considerable yearly fairs for corn and goose-feathers; the other places are unimportant.

In the arrondissement of Mirande are the capital, on the Bayse; Ile de Noé, or Ile Bayse, on the same stream; Beaumarchez and Plaisance, on the Arros; Miélan, Tilhac, or Tillac, and Marciac, on the Boues, a feeder of the same stream; Masseube, on the Gers; Vulla, Barcelonne, or Barcelone, Riscle, Aignan, Lupiac, Bassoues, and Montesquiou. Mirande was formerly capital of the district of Astarac; it is tolerably well built, and is still surrounded by walls in good repair. The neighbourhood is barren. The town carries on some trade in wine, brandy, wool, and leather.

In the arrondissement of Condom are the capital [CONDOM], on the Bayse; Valence, on the same river; Nogaro and Monguillem, on or near the Midou; Manciet and Cazaubon, on the Douze; Eause (pop. 3202 commune), on the Gelize, a tributary of the Lauboue, which flows into the Losse; Monréal, on the Lauboue; Le Houga, Lanepax, Gondrin, and Lialores. Eause, or Eauze, derives its name from Elusa, an antient city, which in the time of the Romans was the capital of the Elusates, and metropolitan see of Novempopulana, a district embracing all that part of Gaul which was S.W. of the Garumna, or Garonne. In the eighth or ninth century Elusa was destroyed by the Normans, and the metropolitan see was transferred to Auch, the diocese of Eause, the town which rose out of the ruins of Elusa, being a simple bishopric. The ruins of the Roman city, which preserve the designation of La Ciutat,

are a little way from the modern town. There are many distilleries at Eause and at Cazaubon. There are handsome baths at the mineral springs of Castera du Vivent, between Condom and Auch.

In the arrondissement of Lombez are the capital, on the Save; Samatan and Ile Jourdain (pop. 1579 town, 4307 commune), on the same river; Simorre and Villefranche, on the Gimone; Cologne, Touget, Montferrand, and Montpezat. Lombez was formerly capital of Bas Comminges. The neighbourhood is one of the most fertile spots in the department, but is liable to be devastated by the floods of the Save. Ile Jourdain had formerly strong fortifications, now dismantled, and a castle, now razed. The former counts of this town had frequent broils with the counts of Toulouse.

The population of the towns, where not otherwise noticed, is from the census of 1831.

The manufactures and commerce of the department are of little importance; they comprehend a few linens, woollens and cottons; some starch and glass: the distillery of brandy is of more consequence. There are several tanyards and flour-mills, and quills for writing are prepared in considerable quantity. Mules and horned cattle are exported to Spain.

The department constitutes the archiepiscopal diocese of Auch; it is comprehended in the jurisdiction of the *Cour Royale* of Agen; and in the circuit of the *Académie Universitaire* of Cahors; it is in the 10th military division, the head-quarters of which are at Toulouse; and sends five members to the Chamber of Deputies.

In respect of education, this department was a little below the average of France before the measures taken for the promotion of education within the last few years.

GERSON, JOHN CHARLIER DE, chancellor of the University of Paris, surnamed the Most Christian Doctor, was born in 1363, at the village of Gerson, in the diocese of Reims, from whence he took his name. He began his studies at Paris, where, having risen by degrees, he attained the place of chancellor of the university, and became canon of Notre Dame. France was during that period disturbed by civil wars, and all Europe was agitated by the religious contest between the popes and anti-popes. Gerson distinguished himself in his own country by loudly inveighing against the assassination of the duke of Orleans, which exposed him to a severe persecution from the duke of Burgundy's party. His house was pillaged by an infuriated mob, and he escaped with his life only by concealing himself for some time in the vaults of the church of Notre Dame. His courage was not subdued by this occurrence, and as soon as he resumed his functions he vigorously attacked, before the university and the clergy, the doctrines of Jean Petit, a doctor of the University of Paris, who defended the murder of the duke of Orleans as a legitimate act in a public oration delivered on the 8th March, 1403, where he maintained that it was permitted, and was even praiseworthy, to kill a tyrant; and that it was allowable to employ for the attainment of that object all possible means. Gerson zealously advocated the convocation of the council of Pisa by his memoir 'De Unitate Ecclesiæ.' At that council he distinguished himself by great firmness united with much prudence, when the two contending popes, Gregorius XII. and Benedict XIII., were deposed, and Alexander V. elected. It was on this occasion that he published his celebrated treatise 'De Auferibilitate Papæ.' He appeared at the council of Constance as the ambassador of Charles IV. king of France, and the representative of the French church and of the University of Paris. In that assembly he exercised an immense influence, particularly in the deposition of Pope John XXIII., who had succeeded Alexander V. In all his speeches and in all his writings he maintained that the church had the right to make reforms, not only with relation to her members, but even to her chief: that it had the right of convoking a council without the consent of the pope, whenever he refused to give it. He also maintained that it was necessary to convoke councils general as well as particular, to abolish the annates, and to extirpate simony, which was then very common, &c. By his influence he established as a basis of all the decrees of council the doctrine of the supremacy of the church over the pope in matters of faith and discipline. Gerson disputed at the Council of Constance with Huss, against whom he declared himself with violence. Though Gerson would have added to his reputation by preventing the martyrdom of the Bohemian reformers, it must be admitted that he was in many respects superior to the superstitions of his time. He strongly condemned in his treatise 'Contra Sectam Flagellatorum' the self-torments inflicted by those fanatics, which were zealously promoted by St. Vincent Fererius, to whom Gerson addressed his friendly remonstrances on that subject. In his work entitled [illegible] established the rules by [illegible]ich a true may be distinguished from a false revelation; and he is far from being favourable to the revelations of St. Bridget, which made a great noise in his time.

The revelations of St. Bridget, a Swedish nun (born 1302, died 1373), obtained a great celebrity. The Council of Basel commissioned the celebrated divine Cardinal Torguemada, or Turrecrimata, to examine into them, who, notwithstanding the contrary opinion of Gerson, recommended them to the approbation of the council, which gave permission to publish them for the edification of the faithful. These revelations were printed for the first time at Rome, 1475, and republished many times in several parts of Europe. The best editions are considered to be that of Antwerp, 1611, and those of Cologne and Rome, 1628. There are three French translations of that work, the first published at Lyon, 1530, under the title of 'Prophétie Merveilleuse de Mme. St. Brigette, jusqu'à present trouvée véritable;' the second, at Paris, 1624; the third, also at Lyon, 1649. An English translation, under the title of 'Certain Revelations of Saynt Briget, with an epistle of Saynt Bernard, called the Golden Epistle,' London, by Thomas Gofrey, 8vo., without date. An edition of the four revelations of St. Bridget was published by Richard Whytforde, London, 1531. There are besides in English, 'The most devout prayers of St. Brigette, touching the most holy passion of our Saviour Jesus Christ,' Antwerp, 1659; and a life of Saynte Brigette, R. Pynson, London, 1516.

The persecution of Gerson by the duke of Burgundy's party was so violent, that he durst not return to France, but was obliged to take refuge in Germany. He went from Constance, in the disguise of a pilgrim, to Bavaria, where he wrote his work 'De Consolatione Theologiæ,' on the model of the celebrated work of Boethius, 'De Consolatione Philosophiæ.' It is written both in prose and verse, and passed through many editions. The 'Imitation of Jesus Christ,' generally ascribed to Thomas à Kempis, appeared for the first time appended to a manuscript of Gerson's above-mentioned work, 'De Consolatione Theologiæ,' dated 1421. This gave rise to the supposition that he was the real author of that celebrated work: and indeed it is a very doubtful point whether this opinion is true or not, there being several high authorities which ascribe to him the authorship of that book. Gerson remained several years in Germany, after which he returned to France, and fixed his residence in a convent of the Celestine monks at Lyon, of which his brother was the superior, and where he died 1429, at the age of sixty-six. (*Biographie Universelle*; *History of the Council of Constance*, by L'Enfant.)

GERVASE OF CANTERBURY, an historian of the thirteenth century, was a monk of Christ Church in that city. His 'Chronicle of the Kings of England,' from 1122 to 1200, and a 'History of the archbishops of Canterbury,' from St. Augustine to Archbishop Hubert, who died in 1205, are his principal works. Both are published by Roger Twysden, in the 'Decem Scriptores.' Bishop Nicolson, in his 'English Historical Library,' 4to., London, 1776, p. 45, ascribes a more extended history to him, of an entire copy of which he thinks Leland had the perusal. MSS. of Gervase of Canterbury are preserved in the Cottonian Collection, Vespas., B. xix., and in the library of Corpus Christi College, Cambridge, cod. 438, both of good age.

GERVASE OF TILBURY, also an historian of the thirteenth century, received his name from Tilbury in Essex, where he was born. Several modern writers state him to have been the nephew of King Henry II., but it is more certain that through the interest of the Emperor Otho IV. he was made Marshal of the kingdom of Arles in France. Bale and Pits differ much in the account of his works. He certainly appears to have written a Commentary upon Geoffrey of Monmouth's History of Britain; a History of the Holy Land; a treatise, entitled 'Origines Burgundionum;' and a History of the Kings of England and France, comprised in a work entitled 'Otia Imperialia,' a fragment of which is printed with his name in Duchesne's 'Historiæ Francorum Scriptores,' tom. iii. p. 363. Manuscripts of the

'Otia Imperialia' are preserved in the Cottonian Collection, Vesp., E. i., and in the Library of C.C.C. Cambr., cod. 414; they comprise the treatises entitled 'Mundi Descriptio,' and 'De Mirabilibus Mundi,' ascribed to him as separate works. Nicolson, *Engl. Hist. Lib.* edit. 1776, pp. 50, 151, ascribes to him the 'Black-book of the Exchequer;' but Madox, who published a very correct edition of that work, gives it to Richard Nelson, bishop of London. (Tanner, *Bibl. Brit. Hib.*, p. 315; Nicholson, *Hist. Lib.*; Nasmith's *Cat. of the MSS. in C.C.C.C.*, p. 388; Madox, *Hist. Excheq.* 4to. edit., vol. ii., p. 338, &c.)

GERVILLIA, a genus of conchifers or bivalves, hitherto only found in a fossil state. M. Defrance first noticed the genus, which he named after M. de Gerville, who discovered in the Baculite limestone of Normandy the species on which the genus was established. M. Deslonchamps (*Mémoires de la Societé Lincenne de Calvados*, 1824) proposed several modifications of the character, so as to allow the genus to embrace four other shells in addition to the first-described species, *Gervillia solenoides*, viz.:—*Gervilliæ pernoïdes* (*Perna aviculoides*, Sow., 'Min. Con.,' t. 66), *Siliqua*, *monotis* and *costatula*, which are figured and described in the memoir. M. Defrance thought that the bivalve was furnished with a byssus, but M. Deslonchamps conceives that *Gervillia* has no opening for the passage of that appendage. 'Should this prove to be the case,' writes the reviewer of the memoir (*Zool. Journ.* vol. i.), 'which we are rather inclined to doubt, it will effectually separate the shells of this from those of the other genera of the *Malleaceæ*. Their nearest affinity is with those of *Perna*, from which they may be at once distinguished by possessing an apparently inner additional hinge, formed of several oblique teeth, variously disposed, according to the species.' Mr. G. B. Sowerby (*Genera of Recent and Fossil Shells*, No. 11), who judges the genus to have been marine from its associates, and who states that there is good reason for presuming that it was adherent by a byssus, gives the following

Generic Character.—Shell oblong, nearly equivalve, very inequilateral, and oblique; hinge line rather long, linear, nearly straight, with many irregular, rather transverse little pits, and teeth placed below the dorsal edge.

Mr. Sowerby regards it as an intermediate genus between *Avicula* and *Perna*. It resembles, he observes, the former in its general form and external appearance; whilst its hinge is somewhat like that of the latter, though sufficiently different to enable us to point out without difficulty the peculiarities by which it may at once be known.

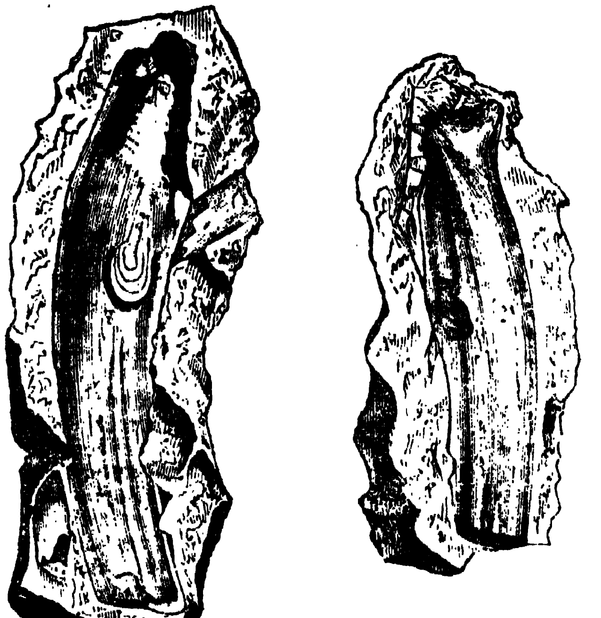
Cuvier, in his last edition of the 'Règne Animal,' places it under *Les Pernes* (*Perna* of Bruguières), between *Crenatula* and *Inoceramus*.

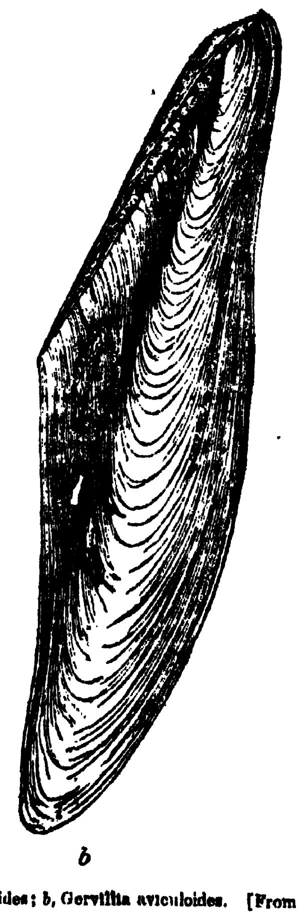
M. de Blainville arranges the genus under his family *Margaritacea* (the third of his *Acephalophora Lamellibranchiata*), between *Pulvinites* and *Avicula*. He notices that the shell gapes anteriorly, perhaps for the passage of a byssus, and describes the ligament as multiple and inserted in many conical fossæ forming a row within the hinge. He also describes the abdominal impression as single, and as rather anterior.

M. Rang gives *Gervillia* a place under the *Malleaceæ* of Lamarck, between *Malleus* and *Inoceramus*. In his description he notices the slight anterior opening as being doubtless (*sans doute*) for the passage of a byssus.

M. Deshayes, in his edition of Lamarck, notices the memoir of M. Deslonchamps, speaks of the multiple ligament and the single somewhat oval muscular impression placed towards the middle of the length of the shell and on the side of the dorsal edge, and remarks that, like the *Pernæ* and other genera of the family *Malleaceæ*, the *Gervilliæ* are covered externally with a delicate layer of fibrous matter, and that they may be regarded as *Pernæ* with an articulated hinge. The place assigned to them by M. Deshayes is between *Perna* and *Catillus*.

Mr. G. B. Sowerby observes that many species have occurred at various geological periods from the lias upward to the Baculite limestone of Normandy. M. de Blainville mentions the species as found in the department of La Manche. M. Deshayes says that they had not been found at the time he wrote (1836), except in the secondary beds. The genus occurs in the *Cretaceous Group* (Green Sand), and largely in the *Oolitic Group*. (De la Beche's *Geological Manual*; Dr. Fitton's *Systematic and Stratigraphical List of Fossils*, in his paper *On the Strata below the Chalk*; *Trans. Geol. Soc.*, 2nd series, vol. iv. 1836—read 1827; and the works of Conybeare, De la Beche, De Caumont, Defrance, Deslonchamps, Deshayes, Desnoyers, Dumont, Hoeninghaus, Holl, Lonsdale, Mantell, Münster, Murchison, Phillips, J. and G. Sowerby, Sedgwick, Thirria, Thurman, Voltz, and the German translation of De la Beche's *Manual*, &c.)





b

a, Gervillia solenoides; *b*, Gervillia aviculoides. [From Sowerby's Genera.]

GERVI'SIA (Zoology), a name given by MM. Quoy and Gaimard to a genus of small mollusks approximating nearly to *Pleurobranchus*.

GERYO'NIA. (Zoology.) [MEDUSA.]

GESNER, CONRAD, an eminent scholar and naturalist, who was a shining example of the truth of the remark, that those who have most to do and are willing to work find

most time. Beginning his career under all the disadvantages attendant on poverty, sickness, and domestic calamity, and cut off at the early age of 48, Gesner left behind him, notwithstanding the cares of the medical profession, which he actively and successfully exercised, such an amount of literary labour as would have won for him the title of one of the most learned and industrious of men, if his useful life had been occupied solely in its production. Zürich was his birth-place, where on the 26th of March, 1516, he came into the world to add to the difficulties of his parents, who were struggling to support a large family. His father appears to have been a skinner or worker in hides; and his mother's name was Friccius or Frick. To his maternal uncle, John Friccius, he seems to have been indebted for kind assistance and tuition:* but this good relation died—the father was killed at the battle of Zug (1531), when the son was only 15—and the poor lad, after struggling with a dropsical disorder, set out for Strasburg to seek his fortune. He was among strangers; but his spirit bore him up, and, in the service of the well-known Lutheran, Wolfgang Fabricius Capito, he resumed the study of the Hebrew language, which he had begun to learn at Zürich. On his return to Switzerland the academy of Zürich allowed him a pension, which enabled him to travel in France. At Bourges, where he stayed a year, Greek and Latin principally engaged his attention, and to assist in defraying his expenses he taught in school. From Bourges he proceeded to Paris, where he does not appear to have done much; and, after a short stay at Strasburg, whither he was led by the hope of employment, the university of Zürich sent for him, and he became a teacher there. He now married, at the age of 20, not with the approbation of his friends, who saw that his income could not be equal to his wants.

The church was his destination, but the strong impulse of his mind stimulated him to the study of physic, to which he determined to apply himself with a professional view; and, resigning his situation at Zürich, he went to Basel as a medical student, his pension being still continued. Here he seems to have commenced his labours for the public in superintending the edition of the Greek dictionary of Favorinus (Phavorinus). A wish to be intimately acquainted with the works of the Greek physicians led him to the acquisition of that language; and he laboured with such earnest zeal and success that he was offered the Greek professorship in the the newly-founded university of Lausanne, an appointment which he accepted. He afterwards passed a year at Montpellier, where he formed an intimate acquaintance with Laurent Joubert, the celebrated physician, and Rondeletius, the great naturalist. His emoluments were now not only adequate to his expenses, but moreover enabled him to prosecute the medical and botanical pursuits so dear to him; and at Basel, in 1541, or, as others say, in 1540, he took his degree of doctor in medicine Zürich was the field of his practice, which enabled him to cultivate his taste for natural history. He founded and supported a botanic garden, collected a fine library, made numerous drawings, and gave constant employment to a painter and to an engraver in wood. In the midst of his laborious profession, the astonishing industry of the man found time for the principal works on which his fame rests He lived honoured and respected for his talents and benevolence in his native town, till an attack of the pestilence which he had successfully combated in the cases of others, and to which his professional activity most probably exposed him, carried him off in his 49th year. When the plague-boil appeared in his axilla, accompanied by the worst symptoms, he knew that his death was certain. He desired to be carried to his museum, where, amidst the treasures he had collected and surrounded by the old familiar objects of his studies, he breathed his last in the arms of his affectionate wife, for whose conjugal love and piety contagion and death had no terrors, with the calmness of a Christian philosopher. This excellent woman survived him. Gesner left no children.

Thus died Gesner on the 13th of December, 1565, on the fifth day of the attack. His remains rest in the cloister of the great church at Zürich, near those of his friend Frisius. He was bewailed in abundance of Latin and in some Greek verses. Theodore Beza was among the most elegant of these tributaries; and his funeral oration was pronounced by Josias Simler, who wrote his life (1566, 4to.), of which Gesner himself had given some details in his *Bibliotheca*. De Thou in his great history speaks of him with high and deserved praise; but perhaps the most complete biography is that of Schmiedel, prefixed to Gesner's botanical works. He must have been much lamented by his contemporaries; for, in addition to his other amiable qualities, he appears to have been a general peace-maker,—his calm, candid, and amiable temper enabling him to soothe the angry feelings of authors under their real or imagined wrongs. Then again he would lay aside his own labour to assist others; and he devoted his time to the supervision and publication of Moiban's work on Dioscorides for the emolument of his deceased friend's family. Similarity of taste attached him to Valerius Cordus, who died at Rome in 1544, at the age of twenty-nine, whilst on his travels; and the *Historia Plantarum* of the latter was subsequently edited by Gesner, who however appears never to have had a personal interview with Cordus. It was otherwise with David Kyber, with whom Gesner was very intimate, who died of the plague at Strasburg in 1553, and whose *Lexicon Rei Herbariæ Trilingue* was published in that year by the same indefatigable editor, with an epistle to the father of the author full of affectionate consolation.

In the year 1545 Gesner journeyed to Venice and Augsburg, where he made the acquaintance of many learned and meritorious men; and this leads us to the literary works which have justly rendered Gesner's name famous, for then it was that he commenced the publication of his *Bibliotheca Universalis*, a grand design, and the first modern bibliographical work upon a large scale. As it was the first, so it may be, hitherto at least, said to be the last; for though an approach was made to it in Dr. Robert Watt's *Bibliotheca Britannica*, that useful and well-executed work is, as might be expected, conversant chiefly with English books. [BIBLIOGRAPHY, vol. iv., p. 381.] Gesner's *Bibliotheca* was a catalogue of Greek, Latin, and Hebrew works, with criticisms, and frequently specimens of the author quoted, and appeared in 1 vol. folio (1545, Zürich). The volume 'Pandectarum, sive Partitionum Universalium' (1548) may be considered as the second of the *Bibliotheca*. Gesner never published the book relating to medical works, because he did not consider it to be sufficiently perfect. An abridgment of the *Bibliotheca* by Lycosthenes, and completed by Simler and J. J. Fries, was published in 1583 (folio). Haller's *Bibliotheca Botanica* and *Bibliotheca Anatomica* were probably imagined from Gesner's work.

But the *Historiæ Animalium* must be considered the great work of Gesner. These well-filled folio volumes appeared at Zürich in the following order: Viviparous Quadrupeds (1551); Oviparous Quadrupeds (1554); Birds (1555); Fishes and other Aquatic Animals (1556),—this volume contains the labours of his contemporaries and friends Belon and Rondelet, with some additions by himself; Serpents (posthumous and published by James Carron, a Frankfort physician, 1587)—this is more rare than the other vols., and there is usually added a treatise on the Scorpion, posthumous also, and published in the last-mentioned year at Zürich by Caspar Wolf. There is also an edition in German. Of the 'Insects,' some inedited figures of butterflies are all that are known; but that Gesner had not neglected this class of animals is manifest from Mouffet's *Insectorum, sive Minimorum Animalium Theatrum: olim ab Edoardo Wottono, Conrado Gesnero, Thomaque Pennio, inchoatum* (fol., Lond., 1634), which is partly made up from Gesner's fragments. The work does not comprise the Mollusks and Testaceans as a class.

All agree that this compilation, having for its object nothing less than a general history of animated nature, concentrating and critically revising all that had been done before the time of the author, enriched with his own knowledge, and illustrated by many incidental remarks in the departments of botany and medicine, might have been considered as evidence of most persevering and praiseworthy industry, if it had been the production of a recluse whose long life had been entirely spent in the task; whereas it was only one of many books written by a man who gained his subsistence by perhaps the most harassing and time-consuming of all professions, and who died in harness when he was not forty-nine years old.

Gesner, in this work, which he carried out to completion as far as the *Vertebrata* are concerned, followed the method of Aristotle; and though there is not any establish-

* Some of his biographers state that John James Ammian, professor of rhetoric at Zürich, took him to his house and offered to defray the expense of his education, and that he remained with the professor three years studying diligently.

ment of genera, it may be considered as the principal source of more modern zoology, from which succeeding writers drew largely, and of which their publications mainly consisted. Thus it was copied in many parts, almost literally, by Aldrovandus; and Jonston's *Historia Naturalis* is little more than an abridgment of it.

Gesner's *Historiæ* were compressed and appeared under the titles of *Icones Animalium*, &c. This book is much more common than the original.

Passing by the various learned treatises that flowed from Gesner's prolific pen, we must notice the complete translation of the works of Ælian (1556). Gesner's notes also appear in the edition of Gronovius (London, 1744), &c.

This extraordinary man is next presented to us in another point of view; for he is said to have designed and painted more than 1500 plants. A large share of the 1500 figures prepared by Gesner for his 'History of Plants,' and left at his death, passed into the *Epitome Matthioli*, published by Camerarius in 1586; and in the same year, as also in a second edition in 1590, they were used as illustrations of an abridged translation of Matthiolus, bearing the name of the *German Herbal*. The same blocks were used by Uffenbach (1609) for the Herbal of Castor Durantes, printed at Frankfort, and comprising 948 of Gesner's. After the death of Camerarius, Goerlin, a bookseller of Ulm, purchased the blocks, and they embellished the *Parnassus Medicinalis Illustratus* of Becker (Ulm, 1633). In 1678 they found a place in Bernard Verzacha's *German Herbal*; and they appeared again in the *Theatrum Botanicum* (Basel, 1696), and in an edition of that work so late as 1744.

Besides the above, Gesner is said to have left five volumes, consisting entirely of figures which, together with his botanical works in manuscript, became at last the property of Trew of Nuremberg, and were published under the care of Dr. Schmiedel, physician to the margrave of Anspach (Nürnberg, 2 vols., folio, 1751-1770).

In closing our notice of this amiable, learned, and industrious man, it may not be uninteresting to state that, according to Haller, it is probable that Conrad Gesner was the first short-sighted person who aided the defect of his eye with concave glasses. Plumier dedicated to him a genus of plants of the family *Campanulaceæ*, under the name of *Gesnera*. [GESNERACEÆ.]

GESNER, JOHN MATTHIAS, born near Anspach in 1691, became rector of the school of Weimar, and was afterwards professor of eloquence and poetry at Göttingen. He distinguished himself as a classical scholar. His principal works are: 1. 'Novus linguæ et eruditionis Romanæ Thesaurus, 4 vols. fol., Leipzig, 1749, a useful compilation. 2. 'Primæ lineæ Isagoges in Eruditionem universalem, nominatim Philologiam, Historiam et Philosophiam, in usum prælectionum ductæ,' 2 vols. 8vo., Leipzig, 1775. 3. 'Biographia Academica Gottingensis,' 3 vols. 8vo., 1769. 4. A good and handsome edition of the antient Roman writers on agriculture: 'Scriptores Rei Rusticæ veteres Latini, Cato, Varro, Columella, Palladius, quibus accedit Vegetius de Mulo-Medicina, et Gargilii Martialis Fragmentum,' 2 vols. 4to., Leipzig, 1735, with Notes variorum, and an Index, or Lexicon Rusticum. He published also editions of Horace, Quintilian, Claudian, &c., and of Philopatris 'Dialogus Lucianeus,' with a dissertation on the authority and age of the same. Gesner died at Göttingen in 1761.

GESSNER, SOLOMON, born at Zürich in 1730, and a painter by profession, distinguished himself both as a painter and a poet. His first publication was some pastoral poems, 'Idyllen,' which had a considerable success at the time, but they are rather tame, and have the fault of all compositions of the same kind, that of representing a state of society which does not exist. His 'Tod Abels,' 'The Death of Abel,' written in prose, has ensured to its author a more lasting reputation. He has taken his subject from the impressive event recorded in Genesis, the first visitation of death upon mankind, and that death a murder. In his narrative he has given full scope to his poetical fancy, without however overstepping the boundaries of probability, or laying himself open to the charge of profaneness. But the genuine pathos of the sentiments and the sketch of the patriarchal manners constitute the great charm of the work. The character of Mehala, Cain's wife, is peculiarly interesting. His 'First Navigator' is also a pleasing fiction. Gessner enjoyed much popularity in his lifetime, both among his countrymen and among strangers, and his works were translated into various languages. His habits were simple and domestic. Madame de Genlis gives a curious account of a visit that she paid to Gessner at his country-house near Zürich, and of the interior of his family. Condorcet has written his biography. Gessner died at Zürich in 1787. His correspondence and miscellaneous poems were published after his death. Gessner engraved several of his own landscapes, which are much esteemed. His countrymen have erected a monument to his memory, with his bust, in one of the public promenades at Zürich, near the banks of the Limmat.

GESNERA'CEÆ, a natural order of monopetalous Exogens, allied to Scrophulariaceæ, and with them forming a portion of the Dicarpous group. [EXOGENS.] They are principally characterized by having an ovary more or less inferior, and a parietal placentation. They inhabit the hot and damp parts of South America, and in some cases overrun trees with their rooting stems, in the manner of ivy: the prevailing colour of their flowers is scarlet; some however are purple, as the Gloxinias, and others pale green, as Sinningia and Drymonia. Many beautiful kinds are known in our gardens; and several other magnificent species are figured in Von Martius's 'Nova Genera et Species Plantarum,' vol. iii. They are of no known use.

2 3 1

Leaves and flowers of Gesnera grandis. 1, a corolla laid open to show the interior; 2, a calyx, with the projecting style; 3, a transverse section of a capsule.

GESTURE. [ORATORY.]

GETA, ANTONI'NUS, younger son of the Emperor Septimius Severus, born about A.D. 190, was made Cæsar and colleague with his father and brother A.D. 208. The most remarkable circumstance recorded of him is the dissimilarity of his disposition from that of his father and brother, who were both cruel, while Geta was distinguished by his mildness and affability. He is said to have several times reproved his brother for his proneness to shed blood, in consequence of which he incurred his mortal hatred. When Severus died at Eboracum (York), A.D. 211, he named both his sons as his joint successors in the empire. The soldiers, who were much attached to Geta, withstood all the insinuations of Caracalla, who wished to reign alone, and they

insisted upon swearing allegiance to both emperors together. After a short and unsuccessful campaign against the Caledonians, the two brothers, with their mother Julia, proceeded to Rome, where, after performing the funeral rites of their father, they divided the imperial palace between them, and at one time thought of dividing the empire likewise. Geta, who was fond of tranquillity, proposed to take Asia and Egypt, and to reside at Antioch or Alexandria; but the Empress Julia, with tears, deprecated the partition, saying that she could not bear to part from either of her sons. After repeated attempts of Caracalla to murder Geta, he feigned a wish to be reconciled to his brother, and invited him to a conference in their mother's apartment. Geta unsuspectingly went, and was stabbed by some centurions whom Caracalla had concealed for the purpose. His mother Julia tried to screen him, but they murdered him in her arms, and she was stained by his blood and wounded in one of her hands. This happened A.D. 212, under the consulship of two brothers of the name of Asper. After the murder Caracalla began a fearful proscription of all the friends of Geta, and also of those who lamented his death on public grounds. [CARACALLA.] (Spartianus, in *Historia Augusta*; Herodianus, book iv.; Dion, book 77.)

Coin of Geta.

British Museum. Actual size. Copper. Weight, 312 grains.

Reverses of Coins of Geta.

GETÆ, the name of a northern tribe mentioned in Roman history, inhabiting the country on both banks of the Danube, near its æstuary, and along the western shores of the Euxine. Those who lived south of the Danube were brought into a kind of subjection to Rome in the time of Augustus (Dion Cassius, book 51), and their country, called Scythia Parva, and also Pontus, is well known under the latter name through the poems which Ovid, in his exile, wrote from Tomi, the place of his captivity. He gives in many places a dismal account of the appearance and manners of the Getæ, especially in elegies vii. and x. of the 5th book of his *Tristia*. The maritime part of the country had been in former times colonized by the Greeks: and this may account for the partial civilization of the Getæ south of the Danube, whilst their brethren north of the same river remained in a state of barbarism and independence The Getæ are described by Herodotus (iv. 93) as living in his time south of the Ister (Danube): he calls them the bravest of the Thracians. Some have confounded the Getæ with the Dacians; the latter however lived farther in the interior and west of the Alpes Bastarnicæ, or the Carpathians, in the country of modern Transylvania, whilst the Getæ were to the east of those mountains and between them and the Euxine, occupying the southern parts of the countries now called Bessarabia and Moldavia, on both banks of the Porata or Pruth, and extending from the Danube to the Tyras, or Dniester, which separated them from Sarmatia. Strabo distinguishes the Daci from the Getæ, though he says that both spoke the same language. [DACIA.] The Goths who, under the conduct of Odin or Woden, conquered Scandinavia, came also from the shores of the Euxine, and are supposed by some to have had a common origin with the Getæ. [DANES.]

GEUM, a genus of Rosaceous plants, distinguished from the strawberry by the receptacles of the carpels being dry, and those bodies, when ripe, being furnished with hardened hooked hairy styles, so that the collection of them in each flower resembles a bud. A very common species is the Avens, or Geum urbanum, a perennial hedge-plant with small yellow flowers, and erect hairy branched stems, covered with 3-lobed wedge-shaped notched leaves, having large rounded lobed green stipules at their base. The root of this plant is aromatic and astringent, and is thought to offer the best indigenous substitute for Jesuits' bark. It is said to communicate an agreeable clove-like flavour to beer and wine.

GEYSERS. [ICELAND.]

GEX, a district of France, on the frontier toward Geneva. It was ceded to France by the Swiss in 1601, and was included, with the adjacent districts of Bresse, Bugey, and Valromey, in the military government or province of Bourgogne. Under the Empire it was comprehended in the department of Léman; but when, at the peace of 1814, France lost the greater part of that department, the district was included in the department of Ain. The country of Gex is wholly mountainous, being traversed by the ridges of the Jura, and is bounded on the south-east by the Rhône, which is not here navigable. The inhabitants live on chesnuts for a considerable part of the year. They carry on some trade in cheese, wine, wool (they have large flocks of merinos), and coal.

Gex, the chief town, is on a small stream which flows into the Rhône, and on the high road from Paris to Geneva by Dijon and Dôle. It is small, consisting of one broad main street on a slope. Population in 1831, 1750 town, 2834 commune. Between Gex and Geneva is Ferney, the residence of Voltaire, whose house is still standing.

GHARRA. [HINDUSTAN.]

GHAUTS. [HINDUSTAN.]

GHEBRES. [GUEBRES.]

GHEE, a species of butter used by the natives of India, and prepared by boiling, so that it will keep for a considerable time; it is sometimes used when a year old. The milk, when first taken from the animal, is boiled in earthen pots for at least an hour, and frequently for two and even three hours: it is then allowed to cool, and a little curdled milk, called Tyre, is added to promote its coagulation. By the next morning the whole mass has been converted into tyre, or coagulated acid milk. About five or six inches in depth are then taken from the top of each pot and put into an earthen jar, where it is churned by turning round in it a split bamboo with a very quick motion. After half an hour's churning, some hot water is added, and the operation is continued for another half-hour, when the butter forms. When this butter has been kept two or three days, and has become rancid, as it will during that time in so hot a climate, it is melted in an earthen pot, and boiled until all the water that may be mixed with it is evaporated; a little tyre and salt, or betel-leaf, is then added, and it is put into pots to be kept for use. It has a strong smell, and although very distasteful to Europeans, is in general consumption among all the natives who can afford to buy it. Ghee is a very important article of internal traffic through a great part of India.

GHEEL, or GHEELEN, a town in the province of Antwerp, situated on the Great Nethe, 25 miles E. from the city of Antwerp, and 12 miles S. from Turnhout. It contained in 1830, 1068 houses and 7038 inhabitants, four churches, the largest of which was built about the beginning of the 11th century, seven chapels, and a townhall. From time immemorial Gheel and its neighbourhood have contained a considerable number of insane persons, whom it is the custom to send there from different parts of the country. These unfortunate persons are placed in private families, where they receive the greatest kindness and attention, and to such a point is the good feeling of the inhabitants carried upon this subject, that if any person were found wanting in consideration for the afflicted persons under his charge, they would be taken away and placed with some other family; and such is the moral effect of such a proceeding, that the stigma would be felt as the greatest punishment. The familiarity which, by long habit, the inhabitants of

Gheel have with insanity, has led them to understand the best mode of treatment for each particular state of the disorder, and has enabled them to adopt the most efficacious means for controlling their patients, so that it is exceedingly rare to find any, after even a short residence, exhibit signs of violence. Chains and every other instrument of bodily restraint are unknown among them. The patients almost invariably mix with the family, and employ themselves in the same occupation with those under whose care they are placed, enjoying all the liberty which can safely be given to them. This mode of treatment is said to be followed by the happiest results. The insane persons sent to Gheel are of almost every rank. The chief number is composed of indigent persons sent from the hospitals of other towns, and although the payment for them is extremely small, their treatment is in all respects as kind as is used towards others who are more profitable inmates.

GHENT, properly *Gent*, or *Gend*, and by the French called *Gand*, a city in Belgium, the capital of East Flanders, twenty-three miles south-west from Antwerp, twenty miles south-east from Bruges, and twenty five miles north-west from Brussels, in 51° 3′ N. lat., and 3° 43′ E. long.

The city is built at the confluence of the Schelde and the Lys, and is intersected by a great number of navigable canals which communicate with those rivers, and thus form twenty-six islands connected with each other by numerous bridges. The Sas-van-Ghent canal, which runs from Ghent towards the north into Zealand, where it joins the Neuzen canal, connects Ghent with the West Schelde, and allows sea-going vessels, drawing eighteen feet water, to enter the city. The canal of Sas-van-Ghent was originally intended only for carrying off the superfluous waters of the province, and its adaptation to navigation was determined upon while the work was in the course of execution. The canal was begun and finished in two years. The city of Ghent contributed a million of francs towards the cost; the remainder was furnished by the general government. It was opened for use in December, 1828.

The origin of Ghent, as well as that of many other towns in Flanders, is very doubtful. Some writers assert that the city which existed at the time of the irruption of the Vandals into Belgium in the fifth century, received from them the name of Vandle, which was afterwards changed to Ganda or Gandavum Castrum. This is mere tradition, but it is supposed to receive confirmation from the existence of a fort on the left bank of the Schelde within the city, bearing the name of Wandelaers Kasteel (Castle of the Vandals). About the year 629, king Dagobert sent St. Amand to Ghent to convert its inhabitants from paganism, and he founded two monasteries to the honour of St. Peter, one on a rising ground called St. Peter's Mount, the other near the Antwerp Gate. Many of the inhabitants, who were converted to Christianity by the preaching of St. Amand, bequeathed their wealth to the second of these monasteries. One of these benefactors gave his name to the abbey of St. Bavon, some part of the ruins of which building are still visible: this quarter of the city for some time bore the name of St. Bavon.

In 868 Baldwin Iron-arm, the first count of Flanders, built a fortress at Ghent, which was called Count's Castle. In 941, the first church was built and consecrated to Saint John the Baptist. Eight years after this Otho emperor of Germany entered Flanders at the head of an army, and destroyed everything with fire and sword. In the year 968, Baldwin the Younger, count of Flanders, introduced the art of weaving into Ghent. In 1046, Baldwin of Lille made himself master of the Count's Castle. About this time the city was visited by an epidemic disorder, which carried off more than 600 persons daily.

About the end of the twelfth century, the Flemish nobles, in order to equip themselves with splendor for the Crusades, sold their domains to their vassals, who by that means were enfranchised. Such of them as resided in Ghent proceeded to establish a form of municipal government; they elected sheriffs, adopted a public seal, and established a court of justice. They obtained at this time various privileges in favour of their trade and manufactures, and joined the association of the Hanse Towns. They further obtained from the emperor Frederick I. the free navigation of the Rhine. In 1180 Ghent, which was then a populous city, became the capital of Flanders, and obtained a charter from Count Baldwin of Hainault, with great privileges. The preamble to this charter contains the following remarkable words:—'It is conformable to the law of God, and to the light of reason, that princes who desire to be honoured and served by their subjects should consider it on their part a duty to respect and maintain inviolate the rights and customs of the latter; and it is with these considerations that at the desire of my dear and faithful citizens of Ghent I have assured to them in manner following their rights and customs, as well as the freedom of their city.' The first article of the charter declares that 'The citizens of Ghent owe to their prince fidelity and attachment while he shall treat them conformably to justice and reason, by which mode of acting alone the prince can reign for the advantage of all.' By a regulation passed in 1202, the citizens were disabled from acquiring estates beyond certain very confined limits around the city, which circumstance is said to have been productive of great prosperity to its manufactures. In return for this restriction, the citizens were secured in the monopoly of employments within the city, and for a certain distance round; and all who were unprovided with the means of living independently, or of contributing by their skill to the prosperity of the city, were expelled from it. Considerable inducements were held out to induce foreigners to bring their skill and capital, and to settle among them.

By these means the city increased so rapidly, that towards the end of the thirteenth century it exceeded in extent and population the capital of France. At the beginning of the fifteenth century, the number of its citizens employed in the manufacture of woollens is said to have amounted to 40,000, and in times of war furnished from their number 18,000 men under arms. Charles V., afterwards king of Spain and emperor of Germany, was born at Ghent, in February, 1500. During his reign the city contained 35,000 houses, and a population of 175,000 souls. In 1537 Maria, sister of Charles V., who then administered the government of the Netherlands, de[illegible]d from Flanders an extraordinary subsidy of 1,20[illegible] florins of gold, one-third part of which was to be paid [illegible] the citizens of Ghent, who, having already advanced [illegible]ble sums to the emperor towards the expen[illegible] the war with France, refused to comply with this fresh demand, and made a show of armed resistance, but were speedily reduced to submission; and the emperor, to punish the citizens, took away from them all their privileges, besides confiscating the property of such as had been actively concerned in the revolt, several of whom were condemned to death. On this occasion a citadel was erected for the purpose of holding the citizens in check.

When the confederation was formed for expelling the Spaniards from the Belgian provinces, a congress was held in Ghent; and a document known in history as 'the pacification of Ghent' was publicly signed by the confederates met together in the town-hall, 8th November, 1576. On the 11th of the same month, the Spanish garrison shut up in the citadel capitulated to the citizens. This citadel was afterwards destroyed.

The capitulation signed 17th September, 1584, again placed Ghent under the dominion of Spain; the citadel was rebuilt, and so many of the inhabitants quitted the city that one-third of the houses were empty. In 1598 the Belgian provinces were severed from the crown of Spain in favour of Isabella, daughter of Philip II., who married Albert, son of the emperor of Germany. Ghent was taken by Louis XIV. in 1678, after a siege of six days. The city was occupied by Marlborough in 1706. In 1745 Louis XV. having entered Flanders with Marshal Saxe at the head of 100,000 men, took Ghent by surprise, but the country soon again came into possession of Austria. In 1792 the Netherlands fell under the power of France, and Ghent was constituted the capital of the department of the Schelde, and so continued till the downfal of Napoleon in 1814, when Flanders became part of the kingdom of the United Netherlands. In 1814 the treaty of peace was signed here between Great Britain and the United States of North America, which put an end to the war between the two countries.

Ghent is a handsome well-built city. On the 1st of January, 1830, it contained 11,823 houses, inhabited by 16,438 families, comprising 39,543 males, and 44,240 females. It is surrounded by walls, and has seven entrance gates. The Brussels gate, called also the Emperor's gate, in memory of Charles V., was originally built in 1300, and restored in 1523. The Courtrai gate was destroyed in 1783 by order of Joseph II., and rebuilt in 1803, when it received the name of the Napoleon gate. St. Peter's gate, built in

1430, was reconstructed in 1827: it was through this gate that the French, under Count Lowendahl, entered the city by surprise in 1743, after the battle of Fontenoy. The gate of St. Lievin, the patron saint of the city, was built in 1300: the ruins of this gate are all that remain at this time. The Antwerp gate, built in 1570, and rebuilt in 1782, was taken down in 1828 in the progress of some improvements, and again rebuilt in 1830; the architecture of this gate is much admired. The old Sas-de-Gand gate, rebuilt in 1426, was much injured; it has lately been taken down, and its reconstruction ordered. The Bruges gate presents nothing remarkable in its appearance.

There are several fine promenades in the interior of the city. The finest is on the bank of the canal cut in 1758 to connect the river Lys with the Bruges canal, and called the Coupure. It is planted with three rows of large trees, and is much frequented in spring and autumn. The Boulevards which surround the city are also much used as public walks. The Friday market is a large square space, with a very old tower, in which meetings of the citizens were formerly held, and where criminals are executed. A large iron ring is fixed there in which pieces of cloth found imperfect by examiners are exposed previous to their being given to the hospitals. In the centre of the square, the citizens erected, in 1600, a column fifty feet high to the memory of Charles V. This column was surmounted by a statue of the emperor: it was restored in 1772, and taken down during the revolutionary troubles of 1793.

The cathedral church of St. Bavon, a fine Gothic edifice, was consecrated in 941. Its rebuilding was undertaken in the thirteenth century, but was not entirely finished until the beginning of the sixteenth century. It was formerly dedicated to St. John, and took the name of St. Bavon in 1540, when Charles V. caused the collegiate chapter of the abbey of St. Bavon to be removed to it: twenty years afterwards the church was constituted a cathedral. The tower is remarkable both for its elegance and its height, which is 271 feet. The spire, which was of wood, was destroyed by lightning in 1603, and has not been replaced. The numerous chapels in this cathedral contain some fine paintings, many of which were carried off by the French, but restored after the peace in 1817. One of these pictures, a chef-d'œuvre of Rubens, represents the reception of St. Amand into the abbey of St. Bavon, after having distributed his goods among the poor. The church of St. Michael, situated in the centre of the city, on the bank of the Lys, is built in a light and delicate style of architecture. It contains the only picture by Vandyck which is possessed by the city of Ghent; the subject is the Crucifixion. The parish church of St. James also contains several good paintings. There are many other churches within the city, several of them very antient, and many among them contain paintings and sculptures of considerable merit.

The palace of the university of Ghent, an institution founded by royal ordonnance in 1816, stands on the banks of the Lys. The first stone of the building was laid in August, 1819, and it was finished with great rapidity. The façade is composed of eight columns, of the Corinthian order, copied from those of the Pantheon. The building is large and commodious, and is well furnished with philosophical apparatus and specimens of natural history. The library contains about 60,000 volumes, besides numerous valuable manuscripts taken from suppressed abbeys and convents. This library is open to the public every day except Sunday, for six hours during summer and five hours in winter. There is a botanic garden founded out of the municipal funds, and now attached to the university.

The number of students in the university in 1832 was 292, of whom 141 were students in medicine, and the remaining 151 attended the law classes. An industrial school was founded by the government in 1825, and annexed to the university. The Royal College of Ghent occupies the greater part of the antient abbey of Baudeloo, a vast and very commodious building, in which several of the students as well as the professors reside. The total number of pupils is about 150. The Royal Academy of drawing, painting, and architecture occupies the antient college of the Augustines, to which building additions were made at the cost of the city in 1827. The students who avail themselves of the advantages offered by this institution are very numerous, and amounted in 1833 to more than 700. The studies comprise, besides linear and ornamental drawing, geometry, arithmetic, perspective, and anatomy, as applied to sculpture and painting. The collection of statues in the academy is considered to be valuable. There is also an extensive gallery of paintings taken from the suppressed abbeys and convents in 1795.

Ghent contains 21 public hospitals, besides several private establishments for benevolent purposes. The hospital of Byloke has accommodation for 600 patients, and ordinarily contains 200. This institution was established in 1225. The school for the poor, founded by the magistrates of the city in 1623, contains 150 youths, who receive an education suitable to artisans. Each scholar is instructed in some particular branch of industry. A similar establishment was founded at the same time for poor girls, and is still in existence.

There were in 1832 six communal and 101 private schools in Ghent: the former contained 562 boys, and the latter 1808 boys and 974 girls, together 3404 scholars.

Among the numerous benevolent institutions which Ghent possesses, its charitable workshop—*atelier de charité*—may be mentioned. The end proposed by this institution is the extinction of mendicity. It was established in 1817 by means of subscriptions raised from benevolent individuals, aided by the local government. Any person out of employment, and in a state of indigence, is admitted to work in the establishment. Those who are in health receive wages proportioned to the work they perform, while the payments to invalids or infirm persons are made more with reference to their wants than to the produce of their labour. Separate workshops are appropriated to males and females.

The central prison of Ghent, situated in the Coupure, is remarkable for its size and its judicious arrangements. It was built at two periods; the first part in 1772, at the cost of 48,000*l*., defrayed by the province, the second in 1824, at the cost of 40,000*l*., paid out of the general treasury of the kingdom. Instead of the idleness which in general characterizes the prisons of England, this establishment has all the appearance of a busy workshop. Weaving, and its necessaries of spinning and winding, are the most common employments of both males and females. The two sexes are separated. The women are also employed in washing and mending the clothes of the prisoners, and in the other necessary household duties. One quarter of the prison, which is kept altogether distinct from the rest, is occupied by prisoners confined for short periods as a punishment for small offences, and these prisoners are further classified with reference to their age, to the description of their offences, and the previous rank in life of the individuals. The building will hold 2600 prisoners, but has not hitherto contained more than half that number at any one time. This prison, so far from being a cause of expense, brings in an annual profit to the city of 4000*l*. (50,000 florins). A considerable portion of their earnings is given to the prisoners, part at the time and the remainder at their discharge from prison. This portion is deposited as it is earned in a Savings' Bank, and bears 4 per cent. interest, which is added to the principal, and is given with it to the discharged prisoner.

About 19,000 persons are employed in various occupations connected with the cotton manufacture, in spinning, weaving, bleaching, and printing. It is calculated that the capital embarked in this branch of industry amounts to 1,700,000*l*. Sugar-refining is carried on to a considerable extent in 24 establishments. This branch of industry has of late been much stimulated by means of the bounty given by the Belgian government on the exportation of refined sugar. The rate of duty paid on the importation is equal to fifteen shillings sterling per cwt., and the annual consumption of the kingdom is estimated at twelve millions of kilogrammes, equal to about 11,800 tons, which should therefore yield 177,000*l*. to the treasury. Nearly the whole of this sum is however given in the form of a bounty to the exporters of refined sugar, the revenue from this source having been reduced in 1837 below 5000*l*. It is attempted to justify this course under the plea of giving encouragement to the mercantile navy of Belgium, but it is expected that the growing deficiencies in the revenue, which at length has reached the point just mentioned, will lead to a considerable modification of the present system.

Among the various manufactures carried on in Ghent may be placed those of Valenciennes lace, silk weaving, salt refining, paper-making, woollen-cloths, tanning, bleaching, soap boiling, and pin-making.

Beside the Friday market, horse-fairs are held in Mid-Lent, and on the 23rd of July; there is also a general fair in August.

Ghent is the residence of the governor of the province; it is also the seat of a tribunal of first resort, and of a court of appeal, which last has jurisdiction over the whole province: it is likewise the residence of a bishop.

From returns printed by the former Netherlands government, it appears that the increase of the population of this city by natural means, between 1700 and 1814, was 18,647, the births having amounted during that period to 195,405, and the deaths to 176,758. The mean terms are therefore 1699 birth and 1537 deaths; the greatest number of births (2169) occurred in 1811, and the greatest number of deaths (2780) in 1809. The number of births and deaths in the first and last years of the series respectively were, in 1700, 1662 births and 1021 deaths; in 1814, 2038 births and 2499 deaths. The actual number of inhabitants in 1814 was 62,226. During the next sixteen years the increase was 21,557, or about 35 per cent., equal to a mean annual increase of 2⅙ per cent., showing that a considerable part must have proceeded from immigration.

GHIBELINS. [DANTE; FLORENCE.]

GHIBERTI, LORENZO. Of this sculptor, who makes an epoch in the history of Italian and modern art generally, the precise year of his birth is not known, for though Vasari states it to have been 1380, it is more probable that it was rather earlier; and accordingly some of his later biographers have presumed it to be 1378. He was born at Florence, where he received his first instructions in drawing from his stepfather Bartoluccio, who practised *oreficeria*, a branch of art at that time in high repute, and extending to designing all kinds of ornamental work in metals. He also acquired some practice of painting in his youth, and executed a fresco in the palace of Pandolfo Malatesta at Rimini, in 1401, the year following that in which he left Florence, on account (as he himself informs us in the memoir relative to the competition for the bronze gates of the Baptistery) of a pestilence in the city, and the distressed state of affairs. We learn from the same source that he applied himself with great diligence and ardour to this task, his mind being almost entirely engrossed by painting; but hardly had he completed it when a circumstance took place which proved the means of his signalizing himself, not only as the greatest sculptor of his own times, but as one whose works have excited the admiration of after ages. This was no other than the competition for a second pair of bronze doors for the Baptistery at Florence, worthy to accompany those executed by Andrea Pisano about 1340. This memorable competition attracted all artists of any eminence, and from among their number, seven, including Donatello, Brunelleschi, and Ghiberti, were chosen to make trial of their skill, the subject given them being the Sacrifice of Isaac, to be executed in bas relief as a model for one of the panels. Of the designs produced on this occasion only two have been preserved, namely those of Ghiberti and Brunelleschi, both of which are engraved in Cicognara's 'Storia della Scultura.' Neither of them is free from a certain stiffness in the attitudes, but Ghiberti's exhibits greater elegance in the forms and more judicious composition; Brunelleschi himself not only felt the superiority of his rival, but generously avowed it, and refusing to take any share in the work, solicited that all the sculptures might be entrusted to Ghiberti alone. These doors, which contain twenty compartments, or panels, filled with as many reliefs, consisting of scriptural subjects, besides a profusion of ornamental work in the intermediate spaces, obtained from Michel Angelo the well-known eulogium, that they were worthy to be the gates of Paradise. Yet a modern critic (Von Rumohr), whose discrimination, as well as his intimate acquaintance with early Italian art, entitles his opinion to more than ordinary respect, says that although they display great invention and admirable skill, they in some respects fall short of those by Andrea Pisano, who treating his subjects with greater simplicity, and more conformably with the principles of sculpture, avoided the confused and crowded appearance which prevails in those of Ghiberti. The latter, he goes on to say, give us the spirit of painting working upon materials belonging to the plastic art: so that in order to be fully appreciated and enjoyed, they ought to be looked upon as pictures rather than as mere sculptures—for as such their author evidently conceived them.

Remarks of a similar tendency have been made by others, who have objected to the attempt to give the effect of perspective and distance by means of various degrees of relief as utterly futile, because the parts which are nearly in full relief must inevitably throw shadows on those next them, although these latter may be intended to represent objects at a considerable distance beyond them. On the other hand these productions of Ghiberti display extraordinary genius, an attentive study of nature, and a sudden emancipation from that formal traditionary style of design and composition which had till then been adhered to by the Italian masters of that period.

He afterwards executed for the same building another pair of bronze doors, containing ten reliefs upon a larger scale, representing various subjects from the Old Testament, those of the first door being entirely from the New. Being thus limited as to their number, he endeavoured to render each history as complete as possible, by combining in each compartment four distinct actions. In the first, for instance, he has introduced the creation of Adam, that of Eve, their disobedience in tasting the forbidden fruit, and their expulsion from Paradise: amounting in all to a great number of figures. Among his other works may be mentioned the admirable bronze relief in the Duomo at Florence, representing San Zenobi bringing a dead child to life, and the three bronze statues of St. John the Baptist, St. Matthew, and St. Stephen, at the church of Or San Michele in the same city. He also painted on glass and executed some of the windows in the Duomo. He was even appointed Brunelleschi's coadjutor in the erection of the cupola of the edifice just mentioned: and was consulted by artists and their patrons upon every important undertaking. The exact time of his death is not known, but it is supposed to have happened shortly after he made his will, which was dated November, 1455, when he was about 77 years old.

Several of the bas-reliefs of the second or larger door of the Baptistery, namely, that facing the Duomo, have been engraved by Piroli for a work on the monuments of Modern Italy, previous to the time of Raffaelle; and a very interesting kind of artistical biography of him, including notices of all his most celebrated contemporaries, has been published by August Hagen, under the title of 'Die Chronik seiner Vaterstadt vom Florentiner Lorenz Ghiberti,' 1833.

GHILAN. [PERSIA.]

GHIRLANDAIO (Dominico Corradi, called Del), from the profession of his father, one of the old Florentine painters, was born in 1451, and died in 1495. He was fertile in invention, and later artists often made use of his works. He was one of the first who, with some correctness of outline, gave character to the face; and was the first Florentine whose works evince a due knowledge of perspective. His greatest works, consisting of events in the lives of St. Francis, the Virgin Mary, and St. John the Baptist, are in the Sassetti chapel, the church of the Holy Trinity, and the choir of the church of Santa Maria Novella. His brothers, David and Benedetto, were not equal to him. His son Ridolfo, who died in 1560, aged seventy-five, was a pupil of Fra Bartolomeo and a friend of Raphael, some analogy with whose genius, but with inferior powers, may be traced in his pictures. Dominico has the honor of numbering among his pupils Michel Angelo Buonarotti.

GHIZNI. [AFGHANISTAN.]

GHOOLGHOOLA is a remarkable hill in the valley of Bameean. This valley is situated in Afghanistan, to the north-west of the town of Cabul, at a distance of about 30 or 40 miles. It extends, in general, east and west, and has acquired notoriety on account of the great number of excavations in the mountains which enclose the valley on both sides, but the greater number of the caves on the northern face. The hill of Ghoolghoola, which is detached and in the middle of the valley, is quite honey-combed with excavations, and consists of a continued succession of caves in every direction. Not far from it are two colossal statues, a male and a female, cut out in the mountain-rock; they are in alto-rilievo on the face of the hill. The male figure is about 120 feet high, and the female about 70 feet. They are without symmetry, nor is there much elegance in their drapery. (Burnes's *Travels to Bokhara.*)

GHUNPORE. [HYDERABAD.]

GIANNO'NE, PIETRO, born at Ischitella, in the province of Capitanata, in 1676; studied at Naples, and applied

himself to the profession of the law. From the profits of his practice he managed by assiduous labour and economy to purchase a small country-house, where he spent all the time he could spare from his professional occupations, and where he wrote his great work, 'Storia Civile del Regno di Napoli,' 4 vols. 4to., 1724. Unlike most other historians who had preceded him, and whose narratives were merely chronicles of kings and wars and battles, Giannone laboured particularly to investigate the history of civil institutions, the laws, the manners, and government of the various countries which were afterwards united by the Normans into one state, called by the various names of the dukedom of Puglia and Calabria, Sicily citra Pharum, and lastly kingdom of Naples, and then to describe the changes in the institutions of the monarchy under the Normans, the Swabians, the Anjous, and the Aragonese, and in the time of Charles V. and the Spanish conquest. He next relates the events of two centuries of the Spanish vice-regal administration down to the year 1700. 'Storia del Reame di Napoli,' 1834, by Colletta, is a continuation of Giannone's work. One principal object of Giannone was to draw the distinction, so long left undefined, between the spiritual and the secular powers, and to show by what means and gradual steps the church of Rome, or rather its hierarchy, had trespassed upon those limits, until at last, 'having invaded every civil jurisdiction, it strove to render the empire wholly subservient to the priesthood.' (*Storia Civile*, b. i. ch. 2.) The profound learning of the author in the history and practice of the jurisprudence of the dark and middle ages, and the frequent citation of his authorities, constitute the chief merits of the work. In other respects he has been charged by some and not unfriendly critics with occasional historical and chronological inaccuracies; with borrowing without acknowledgment from Costanzo, Summonte, and other writers who had preceded him: and also with displaying throughout his work a spirit of fixed hostility to the clergy not always restrained within the limits of historical impartiality. But the pretensions of the ecclesiastical power were in Giannone's time so exorbitant, their encroachments so formidable, and their intermeddling so vexatious, as to sour the naturally irritable temper of Giannone, who felt already, and was also warned by his friends, that his boldness would cost him dear. Naples was then under the dominion of the Emperor Charles VI., whose government was rather favourable to Giannone's views: this however did not prevent the author from being assailed, after the publication of his work, by the clerical party, and being openly insulted in the streets of the capital. Being obliged to leave Naples, he went to Vienna, where the Emperor assigned him a small pension out of the Neapolitan treasury. Meantime his book was solemnly condemned by the Inquisition at Rome, and a monk wrote a refutation of it, in which he undisguisedly asserted the absolute authority of the Pope over the temporal state:—*Della Potestà Politica della Chiesa: Trattati due del Padre G. A. Bianchi contro le Nuove Opinioni di Pietro Giannone*, 5 vols., Rome, 1745. In the year 1734 the Austrians lost the kingdom of Naples, and Giannone, who lost his pension at the same time, repaired to Venice in quest of employment, but he there incurred the suspicion of the government, and was ordered away in 1735. He then took refuge at Geneva, where he completed a work which he had begun at Vienna, called 'Il Triregno, ossia del Regno del Cielo, della Terra, e del Papa,' in which he no longer confines his attacks to the temporal pretensions of the papal see, but impugns also several dogmas of the Roman Catholic church. The book was never printed, though MS. copies of it were circulated, and a copious extract of it is found in the biography of Giannone by Leonardo Panzini. Giannone however was, or thought himself, all the while a Catholic; and as he wished to take the sacrament at Easter, and there was then no Catholic church at Geneva, he listened to the advice of a pretended friend from Savoy, who invited him to pass over the border of the Genevese territory to a neighbouring village, where he could perform the sacred rite. The advice was treacherous; Giannone, as soon as he entered the territory of Savoy, was arrested, in 1736, and taken to the castle of Miolans, from whence he was transferred to the fortress of Ceva, and lastly to the citadel of Turin, by order of the king of Sardinia. He was treated however with some degree of attention, but never recovered his liberty, and he died in the citadel of Turin, in March, 1748, at the age of 72, after 12 years of imprisonment. During his captivity he had conferences with a priest, after which he abjured the opinions which had been condemned by Rome, and was consequently relieved from the interdict by the Inquisition. After the accession of Don Carlos of Bourbon to the throne of Naples, that sovereign sent for the surviving son of Giannone, and assigned to him a liberal pension, stating by an edict, dated Portici, 8 May, 1769, 'that it was unbecoming the interest and the dignity of his government to leave in distress the son of the most useful subject and the most unjustly persecuted man that the age had produced.' (Corniani, *Secoli della Letteratura Italiana*; Botta, *Storia d'Italia*, b. xli.) The views of Giannone concerning the total emancipation of Naples from the temporal jurisdiction of the see of Rome were fully acted upon and enforced by the administration of King Charles and his son Ferdinand IV. Giannone's 'Opere Postume,' chiefly in his own defence, were published at Lausanne after his death.

GIANT (γίγας), a man of great or unnatural stature. In the following article we shall mention those deviations from nature which sometimes occur in the proportions of the human form, both as regards the arrest or excess of development; and thus include the description of Dwarfs, or men who are unnaturally small, and beneath the usual size, as well as of Giants, who exceed the ordinary proportions of the human race. In considering this subject we will first allude to the question,—whether the size of man generally was ever different from what it is at the present time? Secondly, we will inquire if it is probable that races or nations of giants or pygmies ever existed? Lastly, we will state the ordinary proportions of the human frame, and enumerate a few examples of men who have much exceeded or have fallen far short of the common standard, and inquire whether these peculiarities of stature can be accounted for in any satisfactory manner.

It is a very common opinion, that in the earlier ages of the world men in general possessed superior physical properties, and were of a greater size than they are at present; and this notion of diminished stature and strength seems to have been just as prevalent in ancient times as at present. Pliny observes of the human height (vii., 16), that 'the whole race of mankind is daily becoming smaller:' a most alarming prospect if it had been true. Homer more than once makes a very disparaging comparison between his own degenerate contemporaries and the heroes of the Trojan war. But all the facts and circumstances which can be brought forward on this subject tend to convince us that the human form has not degenerated, and that men of the present age are of the same stature as in the beginning of the world. In the first place, though we read both in sacred and profane history of giants, yet they were at the time when they lived esteemed as wonders, and far above the ordinary proportions of mankind. All the remains of the human body (as bones, and particularly the teeth), which have been found unchanged in the most antient urns and burial places, demonstrate this point clearly. The oldest coffin in the world is that found in the great pyramid of Egypt, and Mr. Greaves observes that this sarcophagus hardly exceeds the size of our ordinary coffins, being scarcely six feet and a half long. From looking also at the height of mummies which have been brought to this country, we must conclude that the people who inhabited Egypt two or three thousand years ago were not superior in size to the present inhabitants of that country. Lastly, all the facts which we can collect from antient works of art, from armour, as helmets and breastplates, or from buildings designed for the abode and accommodation of men, concur in strengthening the proofs against any decay in nature. That man has not degenerated in stature in consequence of the effects of civilization is clear; because the inhabitants of savage countries, as the natives of America, Africa, Australia, or the South-sea islands, do not exceed us in size. It has been supposed that before the deluge men might have been of a larger form than they are at present, as they are said to have lived to a much greater age, but this is a mere assumption, unsupported by any evidence whatever.

When investigating the subject, whether any peculiar races of men have ever existed who have greatly varied in size from the ordinary proportions of our form, we need not allude to the fabulous stories of the giants and pygmies of antiquity, the former of whom are said to have made war against Jupiter, and the latter to have been not more than a foot high, and to have carried on war against the cranes which used to come and plunder them. Mention

is made of giants in several places in Scripture; before the flood, in the sixth chapter of *Genesis*, and more plainly after it, *Numb.* xiii.: but, as Dr. Derham observes, the antients vary as to the signification of the Hebrew word *nephilim* in Genesis. Some translate it by a word signifying 'violent men,' and think that instead of giants in stature, monsters of rapine and wickedness were intended to be represented; and Dr. Johnson says that the idea of a giant is always associated with something fierce, brutal, and wicked. With regard to the giants in *Numbers*, who are more particularly mentioned, it is probable that the fears of the spies magnified their dimensions. Races of giants are also alluded to by the Greek and Roman historians. The Germans are particularly noticed by Cæsar (*De Bel. Gall.*, lib. 1), and by Tacitus (*De Morib. German.*, c. 4) as being of large size. We have no data for determining their exact stature, but there is no proof that it exceeded that of the tallest of the present German races, many of whom, as the inhabitants of Saxony and the Tyrol, are very large men. The notion of the existence of giants in former times has, in many instances, been founded on the discovery of the bones of different large animals belonging to extinct species, which have been ascribed to human subjects of immoderate stature. (See the story in Herodotus, i. 68.) The bones of an elephant have even been figured and described by Buffon as remains of human giants, in the supplement to his classical work (tom. v.). The extravagance of such suppositions has been completely exposed by the accuracy of modern investigation.

Descending to more modern times, the people who have excited the most curiosity and given rise to the most conflicting statements are the Patagonians. The first navigators by whom they were observed represented them as being of colossal stature, but though more recent and accurate accounts describe them as being a very tall race of men, yet the highest does not much exceed seven feet. Captain Wallis measured several of them carefully, and found that the stature of the greater part was from 5 feet 10 inches to 6 feet. The height of the Patagonians was also measured with great accuracy by the Spanish officers in 1785 and 1786; they found the common height to be from 6½ to 7 feet, and the highest was 7 feet 1¼ inch.

It was once supposed that a nation of white dwarfs existed in the interior of Madagascar called Quimos or Kimos, with very long arms, but the report is now believed to be perfectly fabulous, and the only fact adduced in support of it was that the Count de Modave, the governor of the French settlement at Fort Dauphin, purchased a female slave of light colour about three feet and a half high, with long arms reaching to her knees. Blumenbach thinks that this was merely a malformed individual. From these and similar observations we may conclude that there is no truth in the existence of giants or dwarfs, except in peculiar individual instances; at any rate, as Dr. Pritchard observes (*History of Mankind*), 'every variety of stature which has been found to occur, as the general character of a whole race, is frequently surpassed by individual examples among the inhabitants of the same country.

There is no fixed law by which the human stature can invariably be determined, though there is an average standard from which the deviations either way are not very considerable. The human race varies mostly in height from four feet and a half to a little more than six feet, though men are occasionally met with of a much greater stature. Taking away the disposition to deal in the marvellous, we may probably assert that no man ever existed of the height of more than eight or nine feet. This may be supposed from what we see at present, and from the deviations which occur in the ordinary course of nature in animals. A skeleton was dug up some years ago on the site of a Roman camp near St. Albans beside an urn inscribed Marcus Antoninus. Mr. Cheselden, who has described it in the *Phil. Trans.*, No. 333, judged that it was 8 feet in height. Goliah, Og king of Basan, Maximinus the emperor, and others mentioned in sacred and profane history, were also probably very tall men, whose height has been magnified, but who were no bigger than some now occasionally met with. There are many authentic instances of men who have much exceeded the ordinary height, which have occurred in our own times: one of the king of Prussia's gigantic guards, a Swede, measured 8½ feet; and a yeoman of the Duke John Frederic, at Brunswick-Hanover, was of the same height. (Haller, *Element. Phy.*, lib. xxx., sec. 1.) Several Irishmen, measuring from 7 to 8 feet and upwards, have been exhibited in this country; the most celebrated, whose skeleton is in the museum of the College of Surgeons in London, was Charles Byrne, who went by the name of O'Brien: he died at the age of 22, in 1783, and measured 8 feet 4 inches. The skeleton is 8 feet in height. Many examples of dwarfs might also be mentioned. Buffon says that Bebe, the dwarf of Stanislaus, king of Poland, was 23 inches (French) high and well proportioned; he died at 23. But of numerous other instances on record most seem to have been rickety and diseased individuals. Thus in the skeleton, in the museum of the College of Surgeons, of Madlle. Crachami, the Sicilian dwarf, who died at the age of 10 years, and which is only 20 inches in height, the bones appear to have undergone hardly any change after birth. There seems to have been a complete arrest of development, the epiphyses of the bones remaining unossified.

We may remark that the ordinary size of man is particularly well adapted to his wants and uses, and we generally observe that those individuals who deviate greatly from the common standard, either one way or the other, are neither well proportioned nor healthy. The head in giants is commonly too small for the rest of the body, and in dwarfs too large.

Both giants and dwarfs have frequently offspring of similar stature to their own, so that a race of men might possibly arise of extraordinary smallness or gigantic size. Of the propagation of giants we have an experimental proof in a fact related by Dr. J. R. Forster (*Observations on a Voyage Round the World*). It is well known that the king of Prussia had a corps of gigantic guards, consisting of the tallest men who could be drawn together from all quarters. A regiment of these huge men was stationed during fifty years at Potsdam. 'A great number of the present inhabitants of that place,' says Forster, 'are of very large stature, which is more especially striking in the numerous gigantic figures of women. This certainly is owing to the connexions and intermarriages of those tall men with the females of that town.' Dr. Pritchard is of opinion that peculiarities of stature may in some measure be owing to peculiarities of climate. In his 'History of Mankind' (vol. ii.), he observes that 'there are many nations of very considerable stature in South America. The Patagonians are the most remarkable example, but nearly all the nations of this great country, though distinct from each other in language, manners, and descent, are taller and stouter than the average standard of the human species.' 'In Ireland men of uncommon stature are often seen, and even a gigantic form and stature occur there much more frequently than in this island: yet all the British isles derived their stock of inhabitants from the same sources. We can hardly avoid the conclusion that there must be some peculiarity in Ireland which gives rise to these phenomena.' Again: 'The tall, lank, gaunt, and otherwise remarkable figures of the Virginians and men of Carolina are strikingly different from those of the short, plump, round-faced farmers in England, who are of the same race.' Lawrence (*Lectures on Man*) thinks that the source of the deviations from the ordinary stature in man is entirely in the breed, and that they are quite independent of external influences. In endeavouring to account for the diversities of stature which occur we must make an observation which is equally applicable to differences of colour, features, and other particulars, in which individuals and particular races differ from each other, namely, that the law of resemblance between parents and offspring which preserves species, and maintains uniformity in the living part of creation, suffers occasional and rare exceptions; but that under certain circumstances an offspring is produced with new properties different from those of the progenitors.

GIANTS' CAUSEWAY, a remarkable columnar basaltic formation on the northern coast of the county of Antrim, in Ireland, situated about midway between the towns of Ballycastle and Coleraine.

The trap district with which this formation is connected occupies almost the whole of the county of Antrim, and a considerable portion of the eastern part of Londonderry, comprehending an area of about 800 square miles on both sides of the valley of the Bann. The surface rises gradually from the channel of this river till it attains a considerable elevation on each side, when it breaks down in precipitous escarpments, sloping abruptly to the primitive district of Londonderry on the west, and overhanging the coast on the east and north in a series of striking

elevations commencing near Belfast, and terminating west of the embouchure of the Bann. Throughout this area the basalt is found capping all the eminences, and constituting the general superstratum in beds of an average thickness of about 500 feet. Beneath the basalt occurs a series of secondary formations peculiar to this area, which has led to the supposition that they may have been elsewhere removed by some denuding force, 'to which, in this quarter alone, an effectual resistance was opposed by the firm and massive superstratum of basalt which covered and protected them.' (Rev. W. Conybeare, in *Trans. Geolog. Soc.*, vol. iii., p. 127.)

These formations, which are similar to those underlaid by the coal measures of the south and east of England, consist, in descending order, of thick beds of indurated chalk, the white limestone of Antrim, succeeded (unless where the series is broken, as it frequently is, by the superior stratum extending beyond the outgoings of the inferior, as at Fair-head, where the basalt rests immediately upon the coal-measures) by mulatto or green sandstone reposing on blue argillaceous limestone, which again rests on the red sandstone of the coal formation, which appears to underlie the greater part of the basaltic tract.

The mass of basalt is considerably thicker towards the northern extremity of the area, and it is here chiefly that the series of columnar formations occur. There are three distinct beds of such formations, the uppermost of which is perhaps traceable in the cliffs of the Cave hill over Belfast, and is distinctly observable at Fair-head, on the north-eastern extremity of the coast, where the mural precipice of greenstone is articulated into columns of enormous dimensions but rude structure, some of them measuring 250 feet in length by six feet on the side. The same formation appears occasionally to recur along the verge of the precipice which trends westward from hence to Dunseverick, at a short distance from which the two lower beds emerge from the sea, and, rising along the escarpment of the rock, form colonnades of the most striking appearance for a distance of nearly three miles, when the upper one is lost in the surrounding masses of basalt, while the lower stratum sinks again under water, its denuded extremity forming that particular group of columns known as the Giants' Causeway.

A section of the cliff at Bengore-head, immediately adjoining the Causeway, gives the following arrangement:—

	Feet.
1. Basalt, rudely columnar	60
2. Red ochre or bole	9
3. Basalt, irregularly prismatic	60
4. Columnar basalt	7
5. Intermediate, between bole and basalt	8
6. Coarsely columnar basalt	10
7. Columnar basalt, the upper range of pillars at Bengore-head	54
8. Irregular prismatic basalt. In this bed the wacke and wood coal of Port Noffer are situated	54
9. Columnar basalt, the stratum which forms the Causeway by its intersection with the plane of the sea	44
10. Bole or red ochre	22
11, 12, 13. Tabular basalt, divided by seams of bole	80
14, 15, 16. Tabular basalt, occasionally containing zeolite	80
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It is observable that the dimensions of the columns diminish and the perfection of their structure increases as the strata descend. Thus the most perfect arrangement is found in the lowest stratum, of which arrangement the Causeway affords the most perfect specimen. The upper part of the stratum being here denuded for a distance of about 300 yards, exhibits an irregular pavement formed of the tops of polygonal columns, so closely arranged that the blade of a knife can with difficulty be inserted in the interstices. The columns are chiefly hexagonal, but polygons of five, seven, and eight sides, are of frequent occurrence; and there is one instance of a triangular prism. These columns are divided into joints of unequal length; each joint is formed by the adjacent extremities being relatively convex and concave, an arrangement which is further secured by the overlapping of the external angles. These convexities and concavities are segments of spheres, the base of each of which occupies a circle inscribed in the polygon of the pillar; the intervals intercepted between the peripheries of these circles and the sides of the polygon are all in the plane perpendicular to the axis of the column. The stone is the most compact and homogeneous variety of basalt, and is more or less sonorous when struck with a hard substance. The entire mass of these columns, of which about thirty feet are exposed above the surrounding shingle at the highest point of their denudation, bears a strong resemblance to an artificial mole projecting from the base of the cliff into the sea.

It is probable that the columnar beds of which the exposed edges present these remarkable appearances along the coast underlie the capping of tabular basalt to a considerable distance inland, as columnar façades break out on the seaward slope of the entire line of elevations extending from Ballycastle to Bushmills, and indications of a columnar tendency have been observed in beds of tabular basalt as far inland as Glen Rovel, near Cushindall, and at the Cave-hill, near Belfast. Along the coast at Ushet-haven, Roanscarave, and Thivigh, are several smaller causeways nearly as perfect as the one described. The columnar strata of the islands of Rathlin and Staffa indicate the extent of the same formation northward and eastward.

The vicinity of the Giants' Causeway affords numerous appearances confirmatory of the opinion that the basalt when superinduced over the secondary strata was in a state of fusion from heat: such are the conversion of old red sandstone into hornstone, the conversion of clay-slate into flinty-slate, the conversion of coal into cinders, and in numerous instances the conversion of chalk into granular marble, all arising from the contact of trap dykes with the altered strata. At Kenbaan, near Ballinoy, the basalt is found inclosing detached masses of chalk, as well interspersed through trap dykes as in the mass of the formation. Similar instances occur near the Cave-hill.

Although this is the most important trap district in Ireland, yet basaltic formations are not altogether peculiar to it, columnar façades having been observed in the county of Limerick. (*Philosophical Transactions; Transactions of the Geological Society*, vol. iii.; *Guide to the Giants' Causeway*, Dublin, 1834.)

GIARDI'NI, FELICE, one of the greatest violinists of the last century, who contributed largely to an improved manner of performing in England, was born at Turin, in 1716, and entered as a chorister in the cathedral at Milan, where he received his elementary education in singing, on the harpsichord, and in composition, and at the same time studied the violin under Lorenzo Gomis, a favourite disciple of Corelli. At the age of seventeen he joined the orchestra of the Opera at Naples; then, making the usual tour of the Italian theatres, visited Germany, and at Berlin excited a *furore* by his performance on the instrument which he early adopted. Giardini, coming to our shores in 1750, immediately distinguished himself, and speedily was appointed to almost every situation of honour and profit that a great violinist could obtain in the British capital. In 1756, joining with the famous *cantatrice* Mingotti, he became manager of the King's Theatre, an office for which he was so little qualified that he soon abandoned it, having sustained a considerable loss by his inconsiderate undertaking. But, untaught by experience, he and his former partner, eight years afterwards, once more embarked in the same concern, and in two years were again compelled to retire from an enterprize so ruinous when not understood. He now pursued his profession as a leader, and also gave lessons in singing. In 1784 he went to Naples, where he became a guest of Sir W. Hamilton, the English minister and a very superior performer on the violin. In 1789 he returned to England, but was coldly received, and failed in establishing a burletta-opera at the little theatre in the Haymarket. In 1793 he took his burletta *troupe* to St. Petersburg, then to Moscow, but was as unsuccessful in Russia as in London. After experiencing many disappointments—the result of bad judgment, singular imprudence, defeated cunning, and habits not over scrupulous—he died at St. Petersburg, in a state of great poverty, in 1796. Giardini possessed much imagination and a fine taste. He composed, partly, three Italian Operas, and one entirely. His English oratorio, *Ruth*, continued to be performed many years; and his songs, 'Let not Age,' 'Tis not wealth' (in *Love in a Village*), with a few others, are still admired by the lovers of pure melody. Besides which he published many quintets, quartets, trios, &c., for violins, and also six harpsichord sonatas;

but his instrumental music is now forgotten, and the probability is that, being deficient in depth and vigour, it will never be revived.

GIBBON. (Zoology.) [HYLOBATES.]

GIBBON, EDWARD, was born at Putney, in the county of Surrey, on the 27th of April, 1737. He has given us in his 'Autobiography,' which was published after his death by Lord Sheffield, copious particulars concerning his life and writings. From his own account we learn that in childhood his health was very delicate, and that his early education was principally conducted by his aunt, Mrs. Porten. At the age of nine he was sent to a boarding-school at Kingston-upon-Thames, where he remained for two years, but made little progress, in consequence of the frequent interruptions of his studies by illness. The same cause prevented his attention to study at Westminster school, whither he was sent in 1749, and 'his riper age was left to acquire the beauties of the Latin and the rudiments of the Greek tongue.' After residing for a short time with the Rev. Philip Francis, the translator of Horace, he was removed in 1752 to Oxford, where he was matriculated as a gentleman commoner of Magdalen College in his fifteenth year. Though his frequent absence from school had prevented him from obtaining much knowledge of Latin and Greek, his love of reading had led him to peruse many historical and geographical works; and he arrived at Oxford, according to his own account, 'with a stock of erudition that might have puzzled a doctor, and a degree of ignorance of which a school-boy would have been ashamed.' His imperfect education was not improved during his residence at Oxford; his tutors he describes as easy men, who preferred receiving the fees to attending to the instruction of their pupils; and after leading a somewhat dissipated life for fourteen months, he was compelled to leave Oxford in consequence of having embraced the Roman Catholic faith. His conversion was effected by the perusal of Dr. Middleton's 'Free Inquiry into the miraculous Powers possessed by the Church in the early Ages,' in which he attempts to show that all the leading doctrines of the Roman Catholic church are supported by the miracles of the early fathers, and that therefore the doctrines of the Church of Rome must be true, or the miracles false. Gibbon's early education had taught him to revere the authority of these fathers; he was induced to read some works in favour of the Roman Catholic faith; and in 1753, he 'solemnly, though privately, abjured the errors of heresy.' With the object of reclaiming him to Protestantism, his father sent him to Lausanne in Switzerland, to reside with M. Pavillard, a Calvinist minister. The arguments of Pavillard and his own studies had the effect which his father desired: in the following year he professed his belief in the doctrines of the Protestant church, and, according to his own statement, 'suspended his religious inquiries, acquiescing with implicit belief in the tenets and mysteries which are adopted by the general consent of Catholics and Protestants.' He remained in Switzerland for five years, during which time he paid great attention to study, and assiduously endeavoured to remedy the defects of his early education.

During his residence at Lausanne, he had become perfectly acquainted with the French language, in which he composed his first work, entitled 'Essai sur l'Etude de la Littérature,' which was published in 1761. 'It was received with more favour on the Continent than in England, where it was little read and speedily forgotten.' His studies after his return to England were much interrupted by attention to his duties in the Hampshire militia, in which he was appointed captain; and the knowledge of military tactics, which he acquired in this service, was not, to use his own words, 'useless to the historian of the Roman Empire.' During his visit to Rome in 1764, 'as he sat musing amidst the ruins of the Capitol, while the bare-footed friars were singing vespers in the temple of Jupiter, the idea of writing the decline and fall of the city first started to his mind.' Many years however elapsed before he began the composition of the 'Decline and Fall.' On his return to England, he commenced a work on the Revolutions of Florence and Switzerland; and in conjunction with a Swiss friend of the name of Deyverdun, published in 1767 and 1768 two volumes of a work entitled 'Mémoires littéraires de la Grande Brétagne.' His next work, which appeared in 1770, was a 'Reply to Bishop Warburton's Interpretation of the Sixth Book of the Æneid.' In 1774 he was returned to parliament by the interest of Lord Eliot for the borough of Liskeard; and for eight sessions he steadily supported by his vote, though he never spoke, the ministry of Lord North, for which he was rewarded by being made one of the commissioners of trade and plantations, with a salary of 800*l.* a year. In the next parliament he sat for the borough of Lymington, but resigned his seat on the dissolution of Lord North's ministry, when he lost 'his convenient salary, after having enjoyed it about three years.' During the time in which he was a member of parliament, he published, in the French language, at the request of the ministry, a pamphlet entitled 'Mémoire Justificatif,' in reply to the French manifesto and in vindication of the justice of the British arms. In 1776 the first volume of the 'Decline and Fall of the Roman Empire' appeared in 4to., and was received by the public in the most favourable manner: 'the first impression was exhausted in a few days; a second and third edition were scarcely adequate to the demand.' The second and third volumes, which terminated the history of the fall of the Western Empire, were published in 1781.

In 1783 he left England, and retired to Lausanne, to reside permanently with his friend M. Deyverdun. From this time to 1787 he was engaged in the composition of the last three volumes of his great work, which appeared in 1788. He spent some time that year in England to superintend the publication, and again returned to Lausanne, where he remained till 1793, when the death of Lady Sheffield recalled him to his native country to console his friend. He died in London, on the 16th of January, 1794.

The 'Decline and Fall of the Roman Empire' comprises the history of the world for nearly thirteen centuries, from the reign of the Antonines to the taking of Constantinople by the Turks; for the author does not confine himself to the history of the princes that reigned at Rome and Constantinople, but gives an account of all the various nations of the west and east which at any period influenced the destinies of the Roman empire. In the prosecution of this design it was impossible for the historian to neglect the history of the Christian church, which he properly considered as 'a very essential part of the history of the Roman empire.' Gibbon accordingly, in the course of his work, entered fully into the history of the church, and in the first volume devoted two chapters to an account of the early progress and extension of Christianity. In relating the causes that occasioned the spread of Christianity, he was supposed to have sought to undermine the divine authority of system; and numerous works were published in opposition to his opinions, to none of which did he make any reply 'till Mr. Davis presumed to attack not the faith, but the fidelity of the historian;' when he published his 'Vindication of the Fifteenth and Sixteenth Chapters of his History.' Gibbon's Sketch of Ecclesiastical History is perhaps the best work on the subject in our language; but it must at the same time be allowed that he writes rather as an advocate than as an historian, and though he seldom if ever wilfully perverts facts, yet he seizes every opportunity of casting ridicule upon the faith which he disbelieved.

The principal fault of Gibbon's history is owing to the extent and variety of the subject-matter. He included in his plan the history of so many nations that no single individual could do justice to every particular. The reading of Gibbon was very extensive, but yet not sufficiently extensive to give an accurate history of the world for thirteen centuries. His knowledge of Oriental history is often vague and unsatisfactory, and his acquaintance with the Byzantine historians is said by those who have studied the subject to be superficial. But, with all its defects, the 'Decline and Fall' was a great accession to literature; it connects antient and modern history, and contains information on many subjects which historians generally neglect and sometimes unsuccessfully attempt. Thus, in the 44th chapter, he gives an historical account of the Roman law, which is perhaps one of the best introductions to its study that we possess, and was considered by a celebrated foreign lawyer, Professor Hugo, to be worthy of a translation. Hugo published it at Göttingen, in 1789, under the title of 'Gibbon's Historische Uebersicht des Römischen Rechts.' The 'Decline and Fall' has been translated into almost all the European languages. The last edition of the French translation contains notes on the history of Christianity, by M. Guizot; and in a biography of Gibbon, by the same writer, in the 'Biographie Universelle,' he has expressed his opinion of the chief merits and defects of the 'Decline and Fall.'

The 'Decline and Fall' was also published in 12 vols. 8vo., London, and has since been frequently reprinted. His 'Miscellaneous Works, with memoirs of his life and writings composed by himself,' were published by Lord Sheffield in 2 vols. 4to., 1796; to which a third volume was added in 1815. The 'Miscellaneous Works' were reprinted in the same year in 5 vols. 8vo. This collection contains a republication of some of the works which have been already mentioned; and in addition to these, a large 'Collection of Letters written by or to Mr. Gibbon;' 'Abstracts of the Books he read, with Reflections;' 'Extracts from his Journal;' 'Outlines of the History of the World;' 'A Dissertation on the Subject of *L'Homme au Masque de Fer*;' 'Antiquities of the House of Brunswick;' 'Mémoire sur la Monarchie des Medes;' 'Nomina Gentesque Antiquæ Italiæ,' 'Remarks on Blackstone's Commentaries;' 'On the Position of the Meridional Line, and the supposed Circumnavigation of Africa by the Antients,' and other pieces of less importance.

GIBBONS, ORLANDO, who was not only 'one of the rarest musicians of his time,' as Anthony Wood styles him, but one of the finest geniuses that ever lived, was born at Cambridge in 1583. At the age of twenty-one he became organist of the Chapel-Royal. In 1622 he was honoured, at Oxford, with the degree of doctor, on the recommendation of his friend Camden, the learned antiquary. In 1625, attending officially the ceremonial of the marriage of Charles I., for which occasion he composed the music, he took the small-pox, and died on the Whit-Sunday following. He was buried in Canterbury Cathedral, where a monument, erected to his memory by his wife, is one of the objects that attracts the notice of visitors to that noble structure. This consists of a bust of Gibbons, over which is a shield containing his arms, and below it a tablet with a highly and justly laudatory inscription in Latin. The whole is simple but elegant, and a noble tribute of conjugal affection. An engraving of this is given by Dart, in his 'History of Canterbury Cathedral.'

Dr. Gibbons left a son, Christopher, who at the restoration, besides being appointed principal organist to the king, and to Westminster Abbey, was created doctor in music by the university of Oxford, in consequence of a letter written by Charles II. himself, which is inserted in the *Fasti Oxon.* He was celebrated for his organ-playing, and is said to have instructed Dr. Blow on this instrument. Orlando had also two brothers, Edward, organist of Bristol, and Ellis, organist of Salisbury. The former was sworn in a gentleman of the Chapel-Royal in 1604, and was master to Matt. Lock. During the civil wars he assisted Charles I. with the sum of 1000*l.*, for which he was afterwards deprived of a considerable estate, and, with his three grand-children, thrust out of his house, at a very advanced age. In the *Triumphs of Oriana* are two madrigals by Ellis Gibbons. 'Burney,' it is observed by the biographer of Gibbons in the *Harmonicon*, 'does justice to the sacred works of Gibbons, which, he says, "are still fresh and in constant use." His service in F is indeed above all praise for novelty, and for richness and purity of harmony. His three anthems, "Hosanna, to the son of David," "Almighty and everlasting God!" and "O clap your hands together," are masterpieces of the most ingenious and scientific writing in fugue that musical skill ever brought forth. But next to his service, we honestly avow our preference for his madrigals: "Dainty sweet bird," and "O! that the learned poets," are far above most other things of the kind; and "The silver swan" is even superior to both of these,—superior, not in elaborate contrivance, for it is comparatively simple, but in effect—the great and only true touchstone of art. Dr. Burney, who has taken very unfair advantage of an expression in the title-page to Gibbons's madrigals, wherein it is said that they are "apt for viols," has criticised them as instrumental pieces, and declared them to be "utterly contemptible." Performed as quintets for stringed instruments, we certainly should not apply any disparaging term to them even in the present day; but when they were written, so little music was printed for violins, &c., that vocal compositions were very commonly pressed into the service of instrumental performers; just as within the last forty or fifty years, songs of all kinds were regularly published with an arrangement for the flute.' (*Harmonicon*, x. 192.)

GIBBONS, GRINLING, an artist celebrated for the extraordinary taste and delicacy of execution he displayed in wood-carving, is supposed to have been of Dutch origin, though a native of London, where he was born in Spur Alley, Strand. Having been recommended by Evelyn to Charles II., the king bestowed upon him a place in the Board of Works, and employed him in the chapel of Windsor, where he executed much of the ornamental carving, consisting of such emblematic objects as doves, pelicans, palm-branches, &c. For the choir of St. Paul's he likewise did much of the foliage and festoons belonging to the stall-work, and those in lime-tree which decorate the side aisles of the choir. There is a great deal of his work at Chatsworth—mere ornament indeed, such as foliage, flowers, feathers, &c., but finished with such exceeding delicacy and truth, that the workmanship not only confers value on the material, but also on the subject. Occasionally he exerted his skill on subjects altogether trivial in themselves, and merely curiosities in art; for instance, feathers and pens that might be mistaken for real ones; and such productions as the point-lace cravat wrought up in wood, which he presented to the duke of Devonshire on completing his labours at Chatsworth. At Southwick, in Hants, he did the embellishments of an entire gallery; and also a room at Petworth, which last has generally been considered one of his chief performances. All these works were merely ornamental, and analogous to what is termed still-life in painting; yet that Gibbons had talents for those of a higher character is proved by his statue of James II., behind the Banqueting House, Whitehall. Yet after all it was in his own peculiar walk that he was distinguished, and he deserves in some degree to be considered as the English Cellini. He died August 3, 1721.

GIBBOUS, convex on both sides; a term particularly applied to the moon when more than half grown.

GIBBS, JAMES, an architect of considerable eminence in his day, and who has since maintained a high rank among English architects, was born about the year 1674 at Aberdeen, where he was educated and took the degree of master of arts at the Marischal college. By the loss of both his parents he was left to his own direction. In his twentieth year he visited Holland, where he entered into the employment of an architect, with whom he continued till 1700, when, by the advice and aided by the assistance of his countryman, the earl of Mar, who had himself a taste for architecture, he proceeded to Italy in order to improve himself in his art. Diligence he did not lack, and therefore as far as relates to making studies, sketches, and memoranda, he may be said to have employed his time successfully, yet that he wanted discrimination, and the ability to improve upon his models is too plainly attested by nearly all his works. After spending ten years in Italy, during several of which he studied at Rome under an architect named Garroli, he returned to England and found his patron, the earl of Mar, in the ministry. By that nobleman he was recommended to the commissioners for building the fifty new churches, and this circumstance opened to him those opportunities which, in the opinion of his admirers, he employed so worthily. Another ten years however elapsed before he was called upon to make trial of his ability in any of the metropolitan churches, for his first one, namely St. Martin's, was not commenced till 1720-21. In the interim he erected what is called the new building at King's College, Cambridge, a design which, if not much distinguished by originality or any other excellence, exhibits comparatively few of Gibbs's faults: and if it gains little by being placed close beside that exquisite architectural gem, the Chapel, neither does it lose much, because there are no points of comparison between the two buildings. If this work is little spoken of, St. Martin's, which was completed in 1726, has been liberally extolled not only as its author's *chef d'œuvre*, but as a first-rate piece of architecture, but chiefly it would seem as an application of a portico upon a satisfactory scale and at a time when such a feature was by no means so common as it has since become. Certain it is that, in regard to the exterior at least, few have extended their eulogium to any other part of it; yet for the portico he found a model ready prepared to his hands requiring only to be adapted to a specific purpose, and if, in selecting it, he paid a tribute to the classical grandeur of the original, he seems to have looked at it only with the eye of a copyist.

Every other feature is at variance with the portico and the order: lumpishly heavy and uncouth, without even anything of that picturesque richness which sometimes results from exaggerated details and other subordinate forms. The windows are fitter for a prison than a church; and some of them being unfortunately allowed to obtrude themselves

within the portico, they and the doors (which are similarly patched over with unmeaning rustic blocks) quite dispel the charm that would be produced by the columns alone. The interior is not at all better: there we behold columns cut by deep galleries which have no apparent support, and whose capitals are surmounted by blocks representing so many broken bits of entablature, from which spring the arches of the ceiling: and this latter is ornamented more profusely than elegantly, or than is in keeping with the rest. For this church Gibbs submitted two other designs, which he himself, he tells us, considered preferable to the one executed. They are both given in the folio volume of designs which he published in 1728, and by which he is said to have made nearly 2,000*l.*, no inconsiderable sum at that time, especially for a work of such a nature. Much as those differ from the present building, the body of the church in both of them being circular in its plan (about 95 feet in diameter), so far from displaying invention, they show, even in the way of alteration, very little more than was absolutely called for by such change of the general form. The taste manifested in them partakes far more of Holland, the country where Gibbs made his first sojourn abroad, than of classical Rome.

The same remark will apply to his next work, the church of St. Mary in the Strand, an exceedingly heterogeneous composition, with nothing in its ensemble to reconcile us to its individual solecisms; and yet, though this building is abandoned to censure even by the architect's professed admirers, it may be questioned whether upon the whole it be not less offensive to sound taste than St. Martin's: for it is at least more consistent in its whims, and is not, like that, an ugly appendage to what would else be a noble portico.

In the church of All Saints at Derby, where he added a new body to the old Gothic tower, he did little more than repeat with some slight variation what he had done at St. Martin's. He also built Marylebone chapel, the upper part of the steeple of St. Clement's Danes, and St. Bartholomew's Hospital. His best work is the Radcliffe library at Oxford, a rotunda about 140 feet in diameter externally, covered by a dome 105 in diameter; for, notwithstanding that the niches and some other parts are the reverse of elegant, there is some approach to simplicity in the general mass and its contours, and something of grandeur in the interior. To this library, which was begun in 1737 and completed in about ten years, and the designs for which he published in a separate volume, containing 23 plates, Gibbs made a valuable bequest of books. He died August 5th, 1754, and having never been married, left his property, amounting to about 15,000*l.*, to different individuals and public charities, not forgetting the son of his first patron, the earl of Mar, to whom he bequeathed a legacy of 1000*l.*, besides an estate worth about 280*l.* a year.

Neither Walpole nor Dallaway speaks at all favourably of Gibbs's talents as an architect; the former even scornfully, yet not otherwise unjustly than because he expresses his opinion too summarily, without adducing any proofs in support of it. His works certainly do not display either grace or happiness of invention. They have for the most part all the heaviness of Vanbrugh's designs, without their other redeeming qualities. They discover neither an innate nor acquired perception of beauty in forms and of harmony in their combination. Nevertheless, in respect of what he almost accidentally borrowed on one occasion, he is generally spoken of, not as a judicious copier, but as an artist of original mind and unquestionable genius.

GIBBSITE, a mineral which occurs massive, in irregular stalactitical and tuberculated masses. Its structure is fibrous, radiating. Its colour is white, with a slight shade of green or grey; streak white: it is slightly translucent, lustre feeble. Its specific gravity is 2·09 to 2·4. Rather harder than calcareous spar; easily reduced to powder.

Before the blow-pipe it whitens, but is infusible; does not effervesce with acids, but loses water by heat.

It is found at Richmond, in Massachusetts, in a neglected iron mine.

It consists of

	Dr. Tovey.
Alumina	64·8
Water	36·7
	101·5

	Dr. Thomson.
Alumina	54·91
Water	33·60
Silica	8·73
Peroxide of iron	3·93
	101·17

GIBRALTAR, a town and fortified rock in Andalusia, the most southern province of Spain. The rock, which is connected with the continent by an isthmus of low sand, and almost wholly surrounded by the waters of the Mediterranean, forms a promontory three miles in length from north to south. The width is irregular, but the entire circumference is about seven miles. Towards the south it terminates in a point called Europa Point, which is in 36° 2′ 30″ N. lat., and 5° 15′ 12″ W. long. This rock, under the name of Calpe, and Mount Abyla (now called Ceuta), opposite to it on the African coast, were called by the antients the Pillars of Hercules, and in very early ages were regarded by the people dwelling to the east of them as the western boundary of the world. (As to Calpe, see Strabo, *Casaub.*, pp. 139, 156, &c.) In the early part of the eighth century an army of Saracens under the command of Tarif, or Tarek, from the coast of Africa, landed near to Gibraltar with the intention of dethroning Roderic, king of Spain. The Saracens erected a castle on the shoulder of the rock, and called the rock itself Gibel-Tarif (the mountain of Tarif), whence its present name of Gibraltar is supposed to be derived. The ruins of this castle may still be seen. The African Moors continued in possession of Gibraltar till the beginning of the fourteenth century, when it was recovered from them by Ferdinand IV., king of Castile and Leon. It subsequently fell into the hands of the king of Granada, from whom it was taken in 1462 by the Christians under Henry IV. king of Castile, who gave it the arms it still bears, viz. a castle with a key hanging to the gate, alluding to its being the key to the Mediterranean. From this time to the end of the sixteenth century Gibraltar remained in the hands of the Spaniards, by whom the fortifications were so far increased and modernized that the place was looked upon as impregnable until taken by an English and Dutch fleet under Sir George Rooke and the prince of Hesse Darmstadt, on the 24th of July, 1704. During the nine following years several unsuccessful attempts were made to recover the fortress by force or stratagem, in which the loss of the assailants was very great. In 1713 the possession of Gibraltar was confirmed to the English by the peace of Utrecht. In 1727 it was again attacked by the Spaniards with an army of 20,000 men. The siege continued for several months, and was terminated by the general peace on the 12th of May. The last and most memorable of all the sieges of Gibraltar was commenced in 1779, and did not terminate till the 2nd of February, 1783. For a detailed account of this siege the reader is referred to the interesting work of Captain John Drinkwater and M. Bourgoing, and also to the 'Life of General George Augustus Elliot (afterwards lord Heathfield), the governor and brave defender of Gibraltar, whose conduct throughout forms one great example of moral virtue and military talent. The grand attack took place on the 13th of September, 1782. On the land side, besides stupendous batteries mounting 200 pieces of heavy ordnance, there was an army of 40,000 men, commanded by a victorious general, the Duc de Crillon, and animated by the immediate presence of two princes of the crown of France. In the bay lay the combined fleets of France and Spain, consisting of 47 sail of the line, numerous frigates and smaller armed vessels, besides ten battering ships, which alone had cost upwards of 500,000*l.* Four hundred pieces of the heaviest artillery (reckoning both sides) were playing at once. The battering ships were found to be of so formidable a construction that the heaviest shells rebounded from them. Eventually however two of them were destroyed by the incessant discharge of red-hot shot from the garrison, and the remaining eight were burnt by the enemy to prevent them from falling into the hands of the besieged. The remainder of the enemy's squadron also suffered considerably; but notwithstanding their failure the assailants kept up a less vivid fire for more than two months, and the siege did not finally terminate till the 2nd of February, 1783, when it was announced that the preliminaries of a general peace had been signed. The expenditure of the garrison exceeded 8300 rounds (more than half of which were hot balls), and 716 barrels of powder. That of the enemy could not be ascertained, but their loss, including prisoners, was estimated at 2000, while that of the garrison only amounted to 16 killed and 68 wounded. While the floating batteries were on fire a detachment of British marines under Brigadier Curtis, was humanely and successfully employed in rescuing numbers of the enemy

from their burning citadels. The failure of this memorable attempt to wrest Gibraltar from the possession of England has been partly attributed to a want of co-operation among the enemy's forces, but the principal cause was, no doubt, the gallant defence made by General Elliot and his brave garrison, notwithstanding their frequent and extreme suffering from want of provisions and from the prevalence of disease.

The rock consists principally of a grey compact marble. It abounds with caves, the most remarkable of which is St. Michael's, on the south-west side. The entrance to this cave is 1000 feet above the sea-level, and leads to a spacious hall, apparently supported by massive stalactites. Beneath this is a succession of descending caves beautifully picturesque, but of difficult access. The impurity of the atmosphere has hitherto prevented their being explored to a greater depth than 500 feet below the entrance, but when the writer visited this spot a few months since he was assured by the person who attended him, that at the above depth the waves of the Mediterranean might occasionally be heard beating into the caves beneath. In the perpendicular fissures of the rock bones of various animals, including human bones, have frequently been discovered. The natural productions of Gibraltar are wild rabbits, woodcocks, teal, and partridges; there are also large numbers of monkeys, of a dark fawn-colour, and without tails. The climate is temperate during the greater part of the year, and even in the summer months the excessive heat is allayed by a refreshing sea breeze that sets in during the forenoon and continues till sun-set. The temperature in winter is considerably higher than in the neighbouring country, so that the snow, which falls but seldom, soon disappears, while it continue for many weeks on the mountains of Africa and the Sierra Morena. On whichever side the rock is approached it has a barren and forbidding appearance. From the ship's deck not a spot of verdure can be seen, and yet it is by no means destitute of vegetation, for besides acacias, fig and orange trees, there is a great variety of odoriferous plants. The east and north sides of the rock are, from their steepness, wholly inaccessible. Towards the south it is also very precipitous, but on the west side, where the town is built, it gradually declines towards the bay, where the strength of the fortifications is such that the fortress appears to be impregnable. Besides the fortifications of which we have just spoken, there are two excavations, wrought with extreme labour, in the solid rock, called galleries, which extend from two to three miles in length, and are of sufficient width for carriages. Along these galleries, at intervals of every twelve yards, are port-holes bearing upon the neutral ground and bay. The Spanish lines, which extend across the isthmus, are defended by two forts, the principal of which is called St Philip. The space between these lines and the foot of the rock is called the neutral ground, and it is here that the lazaretto is situated. The town is built on a bed of red sand, near the foot of the north-west side of the hill. It is paved and lighted, and consists chiefly of one street, extending about a mile in length from South-port to Water-port.

The principal buildings are the governor's and lieutenant governor's houses, the Admiralty (formerly a monastery of White Friars), the barracks, victualling-office and store-house, the Spanish church, and Jews' synagogue. Towards Europa Point are the South barracks and navy hospitals, both fine buildings, pleasantly situated, and well adapted to the purposes for which they were built. The water for the supply of the town and garrison is collected during the rainy season, and conveyed to the garrison by means of an aqueduct erected by the Spaniards. The roofs of the houses are so constructed as to receive the falling rain, and to conduct it to a tank beneath, with which every house is provided. The nearest spring is on the neutral ground, and even there the water is brackish. The provisions are principally derived from Africa. The town can neither be called clean nor neat. The houses are built in the English style, without any regard to their ventilation, so essential to the health of the inhabitants, and so studiously observed in all Spanish towns. The inns are mean, and exceedingly dear.

There is a charter according to which all criminal causes are to be determined according to the laws of England. Disputes between debtor and creditor are referred to the judge-advocate from whose award an appeal may be made to the governor, whose decision is final, unless the sum exceed 300*l.*, in which case a further appeal may be made to the privy council at home. Every precaution is taken to prevent the increase of new residents. Foreigners are allowed permission to remain during specified periods on giving the required security. The trade of Gibraltar has much declined within the last half century. In 1831 the declared value of British produce and manufactures exported to this port was 367,285*l.*, and the official value of foreign and colonial produce for the same year was 121,342*l.* Accounts are kept in current dollars of eight reals each; the hard dollar (peço duro) being equal to twelve current reals. The weights and measures are those of England, with the addition of the aroba of 25 lbs.

Gibraltar being a free port, subject to few duties and few restrictions, is a convenient entrepôt for merchandize destined for the neighbouring provinces of Spain and Africa. According to the return made to parliament in 1822, the average annual revenue collected in the town during the two preceding years was nearly 24,000*l.*, which was about sufficient to defray the public civil expenditure of the place: and according to the minutes of evidence taken in 1834 before a committee on colonial military establishments, it appears that the annual expense incurred by Great Britain on account of the garrison in time of peace is 172,439*l.* By the same document it appears that the strength of the garrison in 1834 was 3354 of all arms, and the population of the town is estimated at 16,000 to 17,000, of which number more than 8000 are foreigners. The garrison contains a good library, to which each officer subscribes four dollars annually.

GIBRALTAR, THE BAY OF, formed by the headlands of Cabrita and Europa Points, is commodious, and secure from all the more dangerous winds. The greatest width from east to west is five miles: its greatest length from north to south, reckoning from Rocadillo to Cabrita Point, is about eight miles, and its depth in the centre exceeds 100 fathoms. The tide rises about four feet, and the variation of the needle is 22° 31′. It supplies the garrison with abundance of fish. The shipping is protected by two moles, constructed at great expense, and extending into the bay to the respective distances of 700 and 1100 feet. On the western side is situated the pretty town of Algeziras, which the Spaniards have fortified since Gibraltar has been in the possession of England. A little to the south-west of this town is an island (Isla Verde), which adds to the general beauty of the bay.

GIBRALTAR, THE STRAITS OF, antiently called the Straits of Hercules, are about 12 leagues in extent from Cape Spartel to Ceuta Point, on the African coast, and from Cape Trafalgar to Europa Point, on the coast of Spain. Their width at the western extremity is about eight leagues, but at the eastern extremity it does not exceed five. A strong current is constantly running from the Atlantic into the Mediterranean, which renders the passage of sailing-vessels bound to the westward extremely precarious, and only practicable by means of a brisk Levant wind. Dr. Halley was of opinion that the daily evaporation of the Mediterranean was sufficient to account for the consumption of this constant influx of water, but it should be mentioned that there are two counter-currents along the shores of Spain and Africa respectively, although their breadth and rapidity are small compared with the principal current.

(*Parliamentary Papers*, 1822—1834; Drinkwater's *Account of the Siege of Gibraltar*; Walsh's *Campaign in* 1803; Inglis's *Spain in* 1830; M'Culloch's *Dictionary*; Imrie's *Mineralogical Description of the Rock of Gibraltar, in the Transac. Soc. Edinb.*, 1796.)

GIBSON, Dr. EDMUND, bishop of London, born 1669, died 1748. Bishop Gibson was the son of Edmund and Jane Gibson, of the parish of Bampton, in Westmorland, a district which has produced more persons who have emerged from that obscurity in which their parents had lived, and become eminent in divers walks of life, than perhaps any other in the kingdom. To this it is supposed that the grammar-schools established in those parts of the kingdom have much contributed, but it is more probable that it has been active and industrious grammar-school masters. He pursued his studies with great vigour, first in his own county, and then in the university of Oxford, of which perhaps the best proof that could be required is given by his having at the age of twenty-two prepared an edition of the 'Saxon Chronicle,' with a translation into Latin, and suit-

able indexes and other assistances in the use of that valuable historical remain. The work was printed at Oxford in 1692, in a 4to. volume. This 'Chronicle,' which is highly esteemed by historians, is the work of different hands, and contains an account of English affairs to the year 1154, in which are several things not found in the corresponding chronicles written in the Latin language. At that early period of his life he projected and accomplished an enlarged edition of the English translation of Camden's 'Britannia,' and he had already acquired fame and interest sufficient to engage in his assistance many antiquaries in different parts of the kingdom, by whose contributions the work was enriched, and came forth from the hands of Dr. Gibson a great improvement on the old English edition of Philemon Holland. This work appeared in 2 vols. fol., in 1695. It appeared again in an enlarged form in 1722, and again in 1772. Richard Gough, an eminent topographical scholar, enlarged it still more, and it appeared in 3 vols. fol., in 1789. It was still further enlarged to 4 vols. fol. in 1806. But though works of this kind have their use, it is to be regretted that Bishop Gibson should have preferred making additions to a former work instead of undertaking a description of the British Islands on a plan of his own, embracing many particular heads of information which were excluded from the plan which Camden himself adopted. This would have been an achievement more worthy of himself, and more just to the memory of his illustrious predecessor, whose singularly beautiful and learned work is absolutely lost in the mass of matter which has been heaped upon it. [CAMDEN.] Another early production of Dr. Gibson was an edition of some historical remains of an eminent antiquary of the seventeenth century, Sir Henry Spelman, which was published at Oxford in 1698, under the title 'Reliquiæ Spelmannianæ.' These works show the original predisposition of bishop Gibson's mind: but he did not at that period of his life confine himself to historical literature, for in 1693 he produced an edition of 'Quintilian,' which is highly esteemed.

The proof of industry and learning which these works afforded introduced him to the notice and favour of Tenison, who, in 1694, succeeded Tillotson as archbishop of Canterbury. He was made domestic chaplain to the archbishop, and rector of the parish of Lambeth. He was also made archdeacon of Surrey.

In the reigns of king William and queen Anne there was a warm controversy concerning the nature and authority of the convocation of the clergy. In this controversy Dr. Gibson took a very active part, defending the power of that assembly, in which his historical knowledge was made to bear powerfully on the question. This led to the publication which is regarded as his great work, the 'Codex Juris Ecclesiastici Anglicani,' 2 vols. fol., 1713, in which he has collected the statutes, constitutions, canons, rubrics, and articles of the Church of England, and digested them methodically under proper heads, with suitable commentaries, prefaces, and appendices, forming together a work which is indispensable to the studies of those who desire to understand thoroughly the history of the English church. It was reprinted at Oxford in 1761.

In 1715 he was promoted to the bishopric of Lincoln; and in 1723 translated to London. Wake, the archbishop of Canterbury, was at that time in an infirm state of health, and so continued for some years, during which period the bishop of London was the person chiefly consulted by the court in affairs belonging to the church.

Bishop Gibson was ever a strenuous defender of the rights of the church, considered as a political community; but he was of what is called the liberal school in respect of doctrines, and he warmly approved of the liberty which the law had granted in his time to persons not conforming to the church to meet together publicly for social worship in whatever way and on whatever principles they might themselves approve. He published a large collection of treatises which had been written by divines in the English church against popery, forming three folio volumes, printed in 1738. His 'Pastoral Letters' is the last of his works we have occasion to mention, in which he combats at once unbelief and enthusiasm.

In his private relations the bishop was greatly beloved and respected. He closed a life, extended to his eightieth year, almost unequalled for labour in the annals of literary exertion, in 1748, and was buried at Fulham, with many of his predecessors

GIEN. [LOIRET.]

GIESECKITE, a mineral which occurs in hexagonal prisms. Structure granular, and hence it has been supposed that the crystals are pseudomorphous; fracture uneven: hardness 2·5 to 3·5; colour externally brownish, and internally greenish; opaque, or feebly translucent at the edges; specific gravity 2·832.

Before the blow-pipe it is very refractory.

It was brought from Greenland by Sir C. Giesecke.

Analysis by Stromeyer:—

Silica	49·24
Alumina	33·82
Potash	6·20
Magnesia	1·20
Oxide of iron	3·35
Oxide of manganese	1·15
Water	4·80
	99·76

GIESSEN, a bailiwick of the Grand-duchy of Hesse, ntaining two towns, two market-villages, thirty-five villages and hamlets. Giessen, the chief town of this bailiwick, as well as of the province of Upper Hesse, is built on the banks of the Lahn and Wieseck, which form a junction at this spot in the centre of a beautiful country. It is about thirty-three miles to the north of Frankfort on the Main, and at an elevation of about 430 feet above the level of the sea: in 50° 34′ N. lat. and 8° 40′ E. long. The town is old and ill-built, with the exception of three or four broad streets, is surrounded by the two rivers on all sides, and contains about 770 houses and 7300 inhabitants: their numbers were 4046 in 1806, and 5500 in 1817. The fortifications have been razed and their site converted into shrubberies and promenades. It has three squares, an old castle, an arsenal, three churches, university buildings, a hospital, house of correction, &c. The university of Giessen, which is the only one in the grand-duchy, was established in the year 1607, and is attended by about 400 students. The buildings appropriated to its use are handsome, and contain lecture-rooms, a library, clinical establishment, chemical laboratory, museums of natural history and the arts and sciences, &c Connected with it are the academy for forest economy, gallery of antiques, an obstetric institute and school, a botanic garden, an observatory, schools for educating teachers, and the Senkenberg library, which possesses several scarce MSS. Giessen is the seat of government for the province of Upper Hesse. It is not a place of much commercial industry, and the manufactures are confined to woollen yarn spinning, stocking-knitting, and cotton-weaving, on a small scale.

GIFFORD, WILLIAM, a political writer and critic of no small influence in his life-time, was born at Ashburton, in Devonshire, in April, 1757. He was descended of a family once of some name in the county: but the indiscretion of his ancestors gradually wasted the property, and the early death of both parents left him, at the age of thirteen, penniless, homeless, and friendless. His godfather, on a claim of debt, took possession of their scanty effects, clogged with the charge of the orphan. From him Gifford received little kindness. He spent some time as cabin-boy on board a little coasting-vessel: at the age of fifteen, he was apprenticed to a shoemaker at Ashburton. In spite of a neglected education, his talents showed themselves in a strong thirst for knowledge. Mathematics at first were his favourite study; and he relates that, in the want of paper, he used to hammer scraps of leather smooth, and work his problems on them with a blunt awl. His master, finding his services worth nothing, used harsh means to wean him from his literary tastes; and Gifford, hating his business, sunk into a sort of savage melancholy. From this state he was withdrawn by the active kindness of Mr. Cookesley, a surgeon of Ashburton, who, having become acquainted with his first rude attempts at poetry, and with his sad story, conceived a strong regard for him, and taxed his own purse and interest so effectually as to raise the means of freeing him from his indentures, placing him at school, and sending him, after two well spent years, to Exeter College, Oxford. He appears to have commenced residence about the age of twenty-two or twenty-three. Not long after he sustained a most severe affliction in the untimely death of Mr. Cookesley. But a more efficient and equally sincere friend was soon raised up in the person of Earl Grosvenor, who, in consequence of the casual perusal

of a letter, became interested in Gifford's character and fortunes, gave him a home under his own roof, in or about the year 1782, and in great measure entrusted to him the charge of his son, the present Marquis of Westminster, with whom, though widely differing in politics, Gifford maintained through life an intimate and unvarying friendship. It appears that he did not remain long enough at Oxford to take a degree. Here ends the romantic part of his history; the rest of his life is simply the chronicle of his works.

The first of these, in order of publication, was the 'Baviad,' a paraphrastic imitation of the First Satire of Persius, 1791, a strong stern attack on what was called the Della Cruscan style of poetry, which for its utter folly and emptiness deserved no quarter. A short account of its rise is given in the preface to the 'Baviad,' which put an end to this affectation. Less successful, though not less powerful in execution, was the 'Mæviad,' a similar satire directed against the puerilities and extravagance of the modern drama. The peculiar talent displayed in these two pieces indicated the author's fitness to undertake a translation of Juvenal, a task which he had commenced even before his residence at Oxford, and had never altogether abandoned, though the untimely death of Mr. Cookesley, to whose care the revision of these early efforts was entrusted, had caused it to be laid aside for a time in disgust. The translation of Juvenal was published in 1802, with a short autobiography prefixed, which for its unaffected candour and manliness is worthy of all praise. The diction and versification of the translation are powerful and flowing; and the honest anger, the fearless crushing invective, the stinging sarcasm of the Latin poet, are rendered in so congenial a spirit as to convey to the English reader a satisfactory idea of the original. Some of his minor pieces are tender and beautiful, and indicate that he might have succeeded as a poet in a softer strain. He had paid much attention to old English poetry, the fruit of which appeared in his editions of Massinger, 4 vols. 8vo., 1805; Ben Jonson, 9 vols., 1816; Ford, 2 vols., 1827; and Shirley, 6 vols., 1833: the two last were posthumous. He is said to have meditated an edition of Shakspeare.

In that time of strife, Mr. Gifford entered with his whole heart into the views of the Antigallican party. He was a devoted admirer, and, in later years, an intimate friend, of Mr. Pitt. In 1798 his known ability recommended him to be editor of the 'Antijacobin,' [CANNING, GEORGE], a connection which introduced him to the most brilliant circles of political and literary men, such as Pitt, Canning, Lord Liverpool, the Marquis of Wellesley, Frere, George Ellis, and others. In 1809 he resumed the office of a political partizan upon a more extended scale, as editor of the 'Quarterly Review.' Of the establishment of this celebrated journal, avowedly as a political machine, and as a counterpoise to the Edinburgh, some very interesting notices will be found in Lockhart's 'Life of Scott,' vol. ii., ch. 6 and 7. The selection of Mr. Gifford for its conductor was most happy. A great stock of knowledge, a powerful and ready pen, a strong talent, unchecked by fear or pity, for satire, a full undoubting belief in his political creed, fitted him admirably for his employment; and the success of the Review was most brilliant. His salary was at first 200*l.*; it was gradually increased to 900*l.* per annum. It is asserted that his political partizanship was disinterested, and that he very rarely either asked or received a favour from ministers. He was himself appointed first to the paymastership of the Band of Gentlemen Pensioners, and secondly to a commissionership of the lottery. He was generous in pecuniary matters, and in private life and conversation is reported to have been unassuming and courteous. He appears to have had the power of feeling and inspiring strong friendships. His gratitude to Mr. Cookesley was ardent, and ended only with his life; indeed he made one of that gentleman's family the principal inheritor of his fortune. During the latter years of his life he suffered greatly from asthma, and withdrew from general society. He gave up the editorship of the 'Quarterly Review' two years before his death, which took place December 31, 1826, at his house in James Street, Buckingham Gate. A paper containing an interesting account of his character and manners, purporting to be from the pen of a personal friend, appeared soon after in the 'Literary Gazette,' and is extracted in the 'Ann. Biogr. and Obituary' for 1828. From that and the autobiography prefixed to the Juvenal, the facts of this account are taken.

GIFT (Law), *donum, donatio*, is the transferring of the property in a thing by one man to another, voluntarily and without any valuable consideration.

The giver is called the donor, and he to whom the thing is given is called the donee. By the common law real estate might pass as a gift by livery of seisin without deed, but by stat. 29 Charles II., c. 3, a deed or note in writing is rendered necessary to the transfer of real estate. To complete a gift of goods and chattels delivery is absolutely necessary, for until then the transaction is not properly a gift, but a contract, and the English law will not compel a man to perform his contract unless it is founded on good or valuable consideration.

Gifts are looked at with some degree of suspicion by the law of England, and are in some cases declared void, as against creditors and purchasers for a valuable consideration. [BANKRUPT.]

The distinctions laid down by the civil law as to gifts were numerous. It distinguished gifts into two classes, proper and improper: the proper gift being such as is recognised by the English law; the improper, gifts in consideration of marriage, and that species of gift termed *donatio mortis causâ*. According to the law of England marriage is a valuable consideration, and consequently gifts upon that account are supported against purchasers and creditors.

Many curious distinctions relating to gifts exist in the Hindoo law. (See Colebrooke's *Digest, Hindoo Law*, b. ii. c. 4.) As to the law regulating voluntary gifts established by the Code Napoleon, see *Cod. Civ.*, b. 3, tit. 2.

GIGGLESWICK. [YORKSHIRE.]

GIJON. [ASTURIAS.]

GIL VICENTE, surnamed the Plautus of Portugal, was born about 1485, of an old and distinguished family. Following the wish of his parents, he studied law, which he however soon abandoned for the stage. Having access at court by right of birth, he supplied several dramatic productions, adapted to different occasions, which were represented at the solemnities of the court. His plays were enacted at the court of king Emmanuel, and the first of them was performed in 1504. They had great success, which increased during the reign of Emmanuel's successor, John III., who often played a part in them himself. It appears that Gil Vicente acted himself in his dramas, and it is certain that his daughter Paula (lady of honour to a royal princess) was the first dramatic performer of her time in Portugal, and equally distinguished as a poetess and a musician. Gil Vicente preceded by almost a century Lope de Vega and Shakspeare, and being then the only dramatic author of his time, gained a European reputation. Erasmus, who was probably informed of his fame by the Portuguese Jews who sought refuge in Holland, learned Portuguese in order to read his works.

Gil Vicente may be considered as the creator of the Spanish theatre, having written in the Castilian language his religious drama, which was performed in 1504, on the occasion of the birth of the prince, who was afterwards king John III., and which is anterior in date to all the dramatic productions of Spain. He is also the model that Lope de Vega and Calderon imitated, and on which they improved. His works are, according to Sismondi, full of the extravagancies which frequently disfigure the productions of Vega and Calderon, without possessing their beauties. These faults are however excusable in the works of one who, like himself, was creating a new kind of literature; and his poetry is distinguished by richness of invention, brilliancy of imagination, and great harmony of versification.

Gil Vicente's works were published by his son in 1562, at Lisbon, in one volume folio, and republished at the same place in 4to. in 1586. The editor has divided the dramatic productions of his father into four classes, viz.: 1st, the autos; 2nd, the comedies; 3rd, the tragi-comedies; and 4th, the farces. The autos, or religious plays, of which there are sixteen, were chiefly intended for the celebration of Christmas, and the shepherds perform in them a most important part. The comedies are the worst productions of Gil Vicente, and are, like those of Spain, nothing but dramatised novels, which embrace all the life of an individual the events of which are ill connected and devoid of plot and catastrophe. The tragi-comedies may be considered as rough sketches of the tragi-comedies which were afterwards written in Spain; they contain some touching scenes: none

of them are founded on historical subjects. The farces, eleven in number, are the best part of Gil Vicente's productions, and may be regarded as specimens of the true comedy. They contain a great deal of merriment, and some well-drawn characters, but they are generally devoid of plot. It is a remarkable circumstance that the plot, which is the soul of Spanish plays, is generally neglected in the Portuguese productions of a similar kind. (For further particulars see Sismondi's *Histoire de la Littérature du Midi*, vol. iv.; and *Biog. Univ.*)

GILBERT, GABRIEL, lived in the seventeenth century, but the periods of his birth and death are alike unknown. His works are chiefly dramatic, and are sometimes referred to as specimens of badness; yet it is supposed that Racine has occasionally borrowed his thoughts, and clothed them in more elegant language. The fact of his having produced a tragedy called 'Rodogune,' in the year that Corneille brought out one with the same title, and the remarkable coincidence that the first four acts of both were nearly alike, occasioned a literary controversy as to whether Gilbert had committed a plagiarism or not. Queen Christina of Sweden entertained a high opinion of Gilbert's genius, and appointed him resident of the court of Stockholm in France. On her death he fell into poverty, when M. d'Hervart, a Mæcenas of the time, received him into his own house, where probably he died.

GILBERT, NICOLAS JOSEPH LAURENT, was born in 1751, at Fontenoi-le-Château in Lorraine. His parents, who were poor, nearly exhausted their trifling means in giving him an education. He went to Paris, and endeavoured to raise himself into notice by writing laudatory verses to great persons. This expedient failed, and he became, in consequence, tinged with misanthropy. He joined the anti-philosophic party of the times and wrote against the infidel philosophers a satire called 'Le Dix-huitième Siècle,' and another styled 'Mon Apologie,' as well as several odes and religious poems. He died at the Hotel Dieu, at the early age of 29, whither he had been removed on account of insanity, his death being occasioned by a small key, which in one of his fits he swallowed. His satires are reckoned superior to his odes, but both are severely reprehended by La Harpe as well for the thoughts they embody as for their grammatical defects.

GILD. [Boroughs of England and Wales.]

GILDAS (surnamed Sapiens, or 'the wise'), the most antient British historian now extant, according to Leland, was born in Wales, A.D. 511; but according to other accounts in 493. In the middle of the sixth century he was a monk of Bangor, and a spectator of the miseries and ruin of his countrymen. His epistle, or treatise, 'De Calamitate, Excidio, et Conquestu Britanniæ' is all that is printed of his writing; and is probably all of his that is extant: though Bale and Pits make him author of several other books. It was first published and dedicated to Cuthbert Tonstal, bishop of London, by Polydore Virgil, whose imperfect and corrupt text was reprinted at Paris in the 'Bibliotheca Patrum,' in 1610. The second edition of this work was published in the 'Opus Historiarum nostro Saeculo convenientissimum,' pp. 481–540, at Basel, 8vo., 1541: again, in a separate form, 12mo., Lond. 1568; Basel, in the same year; and Par. 1576: and lastly, from a better manuscript than was used in any previous edition, by Gale, in his 'Rerum Anglicarum Scriptores Veteres,' 3 vols. fol. 1684-7. There is also an English translation, entitled 'A Description of the State of Great Britain, written eleven hundred yeares since,' 12mo., Lond., 1652. Gildas died, according to Archbishop Usher (*Primord.*, p. 477, from the *Annals of Ulster*) in the year 570.

There were two other persons of the name of Gildas in the sixth century, one called Gildas Cambrius, the othe Gildas Quartus, both of whom seem to have been one and the same with Gildas Sapiens.

(Tanner, *Bibl. Brit. Hib.*, p. 329—332; Nicolson's *Engl. Hist. Lib.*, edit., 1776, p. 26.)

GILDING. The process of gilding is one of the most delicate in the manufactures in metal, and its success depends on a nicety of eye, a dexterity of hand, and a practical (though not necessarily a theoretical) acquaintance with the chemical operations involved in it, which cannot be acquired without several months' or even years' experience. Mechanical errors and difficulties are detected and remedied with much greater facility than those which arise in the chemical branch of manufactures. To these latter the processes of gilding and colouring are particularly subject, and more especially the process of gilding; and, in the homely phraseology of the workmen and their employers, the tenacity of the evil spirit to the gilding shop is proverbial, and his exorcism accordingly difficult.

The gold made use of for the purpose of gilding is called 'fine gold,' and is perfectly free from alloy, having been previously properly refined on the cupel, or 'test.' Its form is that which, in metals, is usually termed 'shot,' from its having been poured, or 'shot,' when in a fluid state, into cold water. This operation divides it into pieces of all shapes and all sizes, from the smallest grain, scarcely perceptible by the naked eye, to the dimensions of a pea or a nut. This form of the metal is best adapted for the purpose, because it exposes the greatest possible quantity of surface to the action of the mercury while it is boiled in it, and is thus amalgamated with a less waste of the latter metal by evaporation.

The union of the gold with the mercury is effected by boiling the former in about five or six times its weight of the latter. These proportions are put into an iron ladle, which must have been previously lined with a coating of whitening and water, and then carefully and thoroughly dried. Should there be any moisture left in the lining, or if any cracks should expose the naked surface of the iron, the ebullition of the mercury is so rapid there, owing to the more rapid conduction of the heat, that a portion of the amalgam is thrown out by the violence of the action. It is most economical to place the ladle and its contents within the heated iron cylinder used for the evaporation of the mercury from the articles when gilt, by which arrangement a considerable portion of the mercury which is evaporated during the process is retained by the condensers.

As it is not easy to ascertain by inspection the moment at which all the gold is dissolved, without which the process would be incomplete, and would have to be repeated under circumstances of greater inconvenience than the first essay, and as the continuance of it longer than requisite would occasion an unnecessary waste of the quicksilver, a practical acquaintance with the time required is commonly relied on. That time varies according to the hardness or softness of the gold (that which has been more *annealed* by the refiner appearing browner than the harder and yellower, and requiring a longer time for complete solution), and according to the larger or smaller size of the fragments of gold made use of. In general, half a troy pound of gold is completely dissolved by being kept at the boiling temperature of mercury for about twenty or twenty-five minutes. It is obvious that the boiling should be as gentle as possible, since fast boiling ensures no higher a temperature, and evaporates a greater quantity of quicksilver.

When it has been sufficiently boiled, the amalgam is poured out into cold water, by which it loses a great part of its fluidity, and becomes only semifluid, the consistence depending, of course, on the quantity of quicksilver originally made use of, and the proportion of it that has been evaporated. It is then put into a piece of chamois skin, and squeezed, by which means the particles of quicksilver escape through the pores of the leather, while thos of the gold are safely retained. It is commonly supposed that the leather, after having been once used for this purpose, and had its pores opened by being stretched out of its original shape, lets pass some of the particles of gold, but it is probable that this notion rests upon the traditionary imaginations of the operatives, rather than upon any experimental proof of its correctness. When the mass is felt to be hard and unyielding within the leather, it is weighed, and its value is determined by considering five parts by weight of the amalgam as equal to one part by weight of the gold employed. The amalgam then, if good, is of about the consistence of a stiff clay, has a greasy and gritty feel on being divided by the bone spatula, and is in the most convenient state for being weighed out into the portions requisite for each respective quantity of work. If however the gold be adulterated or the mercury be impure, it often approaches more or less to fluidity, appears dirty, and deposits a black adhesive scum on every thing with which it comes in contact. Even the very best amalgam may be reduced from an almost solid to a fluid form by beating, pressing, and agitation, but it returns to its original state on being left for a few minutes in a state of quiescence.

The main object of bringing the amalgam to this consistence and these proportions is to have it in a form con-

venient for division and apportionment, as well as for the sake of having a uniform standard by which to ascertain the quantity and value of the gold employed. Gold, in the pure state required by gilders, is usually of the value of 4*l.* 7*s.* 6*d.* per oz. troy; quicksilver, about two or three years ago, was worth about 2*s.* 6*d.* per lb. avoirdupois, but owing to a monopoly of the European mines it has more lately varied from 3*s.* 6*d.* to 4*s.* 6*d.* per lb. The amalgam, made in the proportion of one-fifth gold, is reckoned by manufacturers to be worth 1*s.* per dwt., including the gilder's wages and the materials made use of in its application; and this estimation, it will be perceived, will allow for some fluctuation in the value of its ingredients. To this it may be added, that the gold, being in this form less obviously apparent, does not offer so strong a temptation to the honesty of those to whom it is entrusted for use. As, however, this consistence is not adapted for being applied to its intended purpose, without a greater or less dilution by being again boiled for an instant in mercury, many gilders, especially those who provide their own gold, prefer to weigh out the gold which they intend to use, and then to mix it at once with the quantity of quicksilver which experience has taught them to be proper and necessary, and which varies according to the nature of the articles to be covered with it; those which are wrought into deeply indented or highly ornamented patterns, or which are to have their surfaces completely covered, requiring a more fluid amalgam than those which have a smoother superficies, or which are to be only partially gilt.

On the application, however, of this amalgam to the surfaces of either gilding metal, copper, brazen, or similored articles, it is found that as there is no chemical affinity, and consequently no principle of mutual cohesion between the substances thus brought into contact, the direct union of them is impossible. Nor can it be effected by allowing them to remain in contact for any length of tim such an experiment, were it continued for several weeks or months, would be productive of no satisfactory result. The intervention of a solution of nitrate of mercury is therefore used, and it is made by pouring a table-spoonful of quicksilver into about a quart of strong nitric acid, which is termed in commerce 'gilders' aqua fortis.' The red fumes of nitrous gas are instantly evolved, and the mercury is rapidly united with the acid, with the production of considerable heat. This solution is, by the unscientific operatives, termed 'quick-water,' the monosyllable 'quick' being, in their language, a sufficient representative for the more tedious appellation of 'quicksilver.' When it is uncontaminated by the presence of any foreign substance, the 'quick-water' is white and pellucid, nor can it be distinguished from common water except by the slight alteration in appearance which its different refractive power shows to a keen and experienced eye.

When a piece of copper or brass is immersed in or brought in contact with this solution, its surface is immediately converted into an amalgam. The *rationale* of this phænomenon does not seem to have received any explanation in the chemical treatises and popular works hitherto published; but it appears to depend upon a peculiar galvanic circuit formed between the mercury and the copper in the acid medium. To this amalgamated surface mercury and gold amalgam closely adheres, by means of what is termed the molecular attraction of the particles of the fluid metals for each other.

The manner in which this agent is applied in practice varies according to the description of articles to which it is to be applied. If they are small, strong, and to be gilt all over, as copper buttons, buckles, and rings, a quantity of them, which should not exceed three or four pounds in weight, is put into a deep glazed earthen pan, or 'jowl;' to these are added about three or four tea-spoonfuls of the 'quick-water,' together with the requisite portion of amalgam. The whole is then thoroughly stirred with a brush or stick, till the amalgam entirely covers the surface of every article, more particularly the indentations and sunk parts, which are the last to receive a coating, from their being less exposed to the contact of the fluids. When they are completely covered they are by some gilders rinsed in cold water and dried by shaking in a bag of warm sawdust, while by others this part of the process is postponed to a later period of the operation, and they are put, in their wet state, with the generated nitrate of copper still hanging about them, into the cage.

The 'gilding cage' is made in a cylindrical form, and is generally about 18 inches in length by 9 or 10 in diameter. It is formed of coarse iron-wire gauze, supported by an external framework of iron, and furnished with a solid iron door at one extremity, which generally forms a sector of one-third of the circular end. It is provided with an axle, which extends to a length of about three feet from the end at which the door is placed, and is then terminated by a winch, and to a distance of five or six inches in the opposite direction. The articles under process of gilding are placed in this cage, and the door of it securely fastened; it is then suspended by its axle on two supports in an iron cylinder, which something resembles a gas retort, and which is in a similar manner fixed into brickwork over a furnace or stove. The cylinder being previously heated by a coal fire beneath it, to such a degree as to be red-hot over a large proportion of its inferior surface, the cage is introduced, and the doors of the cylinder closed, which do not however fit so accurately as to exclude all access of air to the cylinder, or to prevent a tolerable draught from passing through it. The heated air contained within the cylinder soon raises the temperature of the substances immersed in it, and as the case is kept continually revolving by means of the winch, which projects through an aperture in the doors, they have all an equable share of heat, and allow of a nearly equal evaporation of the mercury from all their surfaces.

The farther extremity of the cylinder communicates with a chamber, which is in general built of masonry and plastered over all the internal surfaces. The floor of this chamber is covered to a depth of about two feet with cold water, which on coming into contact with the mercurial vapours condenses a portion of them, and causes them to return to the liquid form. If this 'condenser,' however, were made quite close, a great portion of the mercurial vapour would return through the cylinder into the apartment or 'gilding shop,' and thus not only be wasted, but materially injure the health of the persons engaged in the work. A communication extending obliquely upwards, and made of one or more ranges of iron stove piping, is therefore connected with a second smaller condenser on the story above, and this is again repeated a third or perhaps a fourth time. A current of heated air is thus continually ascending from the lowest condenser, and establishes a perpetual draught through the cylinder, thus preventing the deleterious mercurial vapour from mixing with the atmosphere of the shop in which the work is going forward, and injuring the health of those employed in it. It is obvious however that by means of the continual free ascent of the vapour a great proportion of it must be lost in the external air, and be irrecoverably wasted. If the draught be so good as entirely to prevent the contamination of the air of the room, about half the quantity of quicksilver employed will perhaps be found the highest average amount retainable in practice. The condensers are opened usually once a year, and the quicksilver taken out, washed, and dried, and it is sometimes found necessary again to distil it, to purify it from all impurities.

After the cage, with its contents, has been in the cylinder for a length of time varying, according to the temperature at which it has been kept, from five minutes to a quarter of an hour, the mercury will be found to have entirely evaporated from the gilt surfaces. If the articles have been previously washed and dried, they will appear of a clear yellow colour, and they may be allowed to remain in the cylinder, the cage revolving as before, until they are sufficiently 'heightened.' If they have not been so treated previously, they will appear of a dark, soiled, dirty colour, being covered with an incrustation of oxide of copper and of iron, and other impurities. To remove these, the goods are taken out of the cage: and after being allowed to cool for a few minutes, they are thrown, while still warm, into 'weak quick-water,' *i.e.* diluted nitrate of mercury. This converts the gold again into an amalgam, owing to the precipitation of a portion of the mercury by the copper, which is taken up with avidity by the gold. They are then washed with clean water, dried in warm sawdust, and again committed to the cage and cylinder, which, by the evaporation of the mercury, give them a clean colour. They may then be heightened, which is done by continuing to revolve them at the same high temperature within the cylinder, occasionally taking out the cage and shaking them together, that they may all have an equal share of the heat, until the copper throws up a thin coating of oxide upon them, which

exhibits a prismatic mixture of various colours, from yellow, through red, violet, and brown, to almost a black. The thicker the coating of gold is, the longer may this process be continued: if the oxidation be carried too far, it occasions a scaly incrustation, which causes the gold to fall off, and renders the whole operation worse than useless, inasmuch as articles can rarely be gilt a second time with success.

The oxidation of the copper however is not the object intended to be effected, or rather it should be said that it is not the purpose for which it is done, though it furnishes a very accurate indication of the extent to which it should be carried. The end intended to be effected is a partial oxidation of the surface of the gold, caused by means of the increased temperature of the metal goods after the mercury has evaporated, and which remains unaffected by nitric or sulphuric acids after the slight film of oxide of copper has been instantaneously removed by their action. This partial oxidation occasions a slight difference of colour, which is perceptible by an experienced eye, and confers on the gold a degree of that orange colour which is so generally admired in golden and gilt articles. The degree to which the 'heightening' ought to be carried differs according to the quality of the gilding. Those which are richest and best gilt may be heightened till they are of a brown colour; the commoner sorts not so much; and yellow similored goods must only have the mercury fairly removed from them.

Buttons and articles of a similar description are often gilt only on their tops, or on some other portion of their surfaces, while the remainder is left uncovered with gold, and of the native colour of the metal of which they are manufactured. This is accomplished by brushing them over the part to be gilt with a hard brush wetted with 'quick-water,' or by rubbing it with a piece of chamois leather similarly moistened. In order to accelerate the process in buttons, &c., they are arranged on boards in holes adapted to receive and retain them; and the 'quick-water' is then applied by the brush. They are afterwards briskly rubbed with a dry brush, which gives them a brilliantly shining metallic lustre, and a colour between that of lead and of silver. They are then put into the 'gilding-cap,' which is a whit felt hat of a peculiar sort and shape. The amalgam for this description of work is brought to a much stiffer consistence than that which is used for 'all-overs,' and is put into the gilding-cap along with them. The whole is then well shaken together for a few minutes, when the amalgam will be perceived clinging to the amalgamated parts of th goods, but leaving the remainder in their original state. They are then put into the cage, the mercury is evaporated and they are afterwards 'quick-watered' in the manner already described.

Many descriptions of articles would be injured or destroyed by the method of gilding just now described. Such are all those which are of considerable dimensions in proportion to the thickness of the metal out of which they are made, as well as those whose individual weight and extent of surface would expose them to such attrition from the rotatory motion of the cage as would occasion the gold laid on to be entirely or partially rubbed off in the process of its application. Besides this, there is in thin and fragile articles an imminent danger of their being broken when they are amalgamated and rendered brittle throughout a great part of their substance by the necessary immersion in the quick-water. To obviate the inconveniences that might result from these circumstances, a different method is employed, so far as regards the mechanical part of it, though the chemical principles on which it depends are precisely the same. Articles of this description are most commonly gilt only on one side, and there are two modes of preventing the amalgam from adhering to those parts of the surface that are intended to be left bare. One is to lacquer those parts (which are of course concealed when the article is fitted to the spot for which it was made), and after the spirit of wine is thoroughly evaporated, to immerse them in the quickwater, and afterwards apply the amalgam. The gummy surface left behind by the lacquer is entirely unaltered by its contact with the mercurial solution, but its exposure to the high temperature necessary in the subsequent parts of the process chars the gum, blackens it, causes it to peel off, and sometimes, if it be not very carefully dried at first, occasions portions of it to adhere to the gilt surfaces of other goods with which it comes in contact by being gilt along with them. The other mode of applying the gold is to distribute the quick-water over the parts requiring it by a small brush or camel's hair pencil, and these then have the amalgam applied as before. If, as is sometimes the case, the goods are to be entirely covered, they are immersed at once in the quick-water.

The goods thus prepared are laid with the gilt surfaces uppermost on an open iron pan, of a shape something like that of a frying-pan, which is held over a coke fire by the operative. The chimney is made wide at the bottom, and narrows rapidly as it proceeds upwards, so as to collect as much as possible of the mercurial vapour, for the recovery of which no effort has hitherto been made. A great proportion however necessarily escapes into the apartment, and renders this mode of gilding much more unhealthy than the use of the cylinder and cage. As the mercury gradually evaporates from their surfaces, their position is changed, when requisite, by means of a short pair of tongs; and when entirely free from it, the process of 'quick-watering' is performed.

It is entirely foreign to the present object to give any remarks on the medical effects of mercury on the human frame. Its consequences, as practically experienced by gilders, consist in soreness of the mouth from salivation, nausea and sickness, an oppressive head-ache, and, after the lapse of a few years, a paralytic tremour and agitation in all the muscles of the body; nor does any treatment seem to be successful which does not include an entire abstinence from the prosecution of this occupation, and even this is unavailing when 'the shakes' have taken possession of their unhappy victim. Distressing instances have been known of this last and worst stage of the effects of the poison, in which the unfortunate sufferer was not only deprived of the power of locomotion, but unable to retain a grasp of even the smallest and lightest utensils made use of in domestic life. The introduction of the cylinder and cage (which, simple as they may seem, have not been in use very many years), has greatly abated this serious evil; and those operatives the nature of whose work prevents them from calling in these accessories may prevent a great portion of the mischievous consequences likely to ensue by a minute and scrupulous attention to cleanliness. A gilder who had by the age of about fifty amassed a little competency by his trade, sufficient to enable him to retire from business, ascribed the unbroken health he enjoyed to the practice of employing about an hour every evening in cleansing his nails and fingers from the minute particles of quicksilver left on them by the labours of the day. He was one of those who work over an open fire.

Where the cylinder is employed, it should be swept out daily, before the fire has heated it in the morning. A portion of the gold amalgam is rubbed off by the attrition of the cage, and falls on the inferior surface of the cylinder, whose heat melts it wholly or partially, and it becomes mixed with the oxide of iron that is constantly in course of production by the elevated temperature of the cylinder. This being carefully collected and refined, is found to yield an average of about 1-30th of the gold employed, to which dividend the richer sorts have contributed from their superabundance a greater proportionate quantity than the commoner qualities.

Much has been said and written respecting the extensibility of gold under the hammer; but this property is much more remarkably developed in its application to gilding. Similored articles are the best adapted to show the extent over which the metal can be spread, since the brass amalgam seems to have a more powerful affinity for the amalgam of gold. In this description of goods a grain of gold will cover about 40 square inches, without leaving a single aperture bare that is perceptible to the naked eye or to magnifying glasses, or discoverable by the action of aquafortis. A cubic foot would therefore cover about 402,640,000 square inches, which gives a thickness for the coating of gold of about 1-233,000th of an inch.

The profits of those engaged in this department of manufactures vary greatly, but they bear a very high proportion to the average of those of the individuals engaged in most other branches. These high profits are a sort of remuneration for the unwholesome nature of the trade, which by its real and imaginary terrors (of which the latter are perhaps the greatest) creates a general reluctance in the working population to allow their children to be brought up to it or to enter it themselves. A gilding woman's wages, who works by the day, are about 4*d.* an hour for six hours in the middle of the day, and 6*d.* an hour for extra time. A

man's time is paid for at a rate of about three times as much, in both instances. But those who are called 'out-gilders,' who find the gold, and charge for the materials and labour together in the gross, are in the receipt of larger profits. The average of some of the more fortunate instances are known only to those who enjoy the advantage, but it may be conjectured that it often amounts to 20*s.* a day. A great deal depends on the power of producing a good appearance with a small quantity of gold, as also upon the colour laid on, which most generally depends on a diversity of preparations and mixtures, which are always kept a profound secret, which is to be revealed only for an adequate remuneration.

There is a remarkable difference between the workmen in this branch in London and in Birmingham, which are the principal and indeed almost the only places where it is carried on. In London, a rich dead orange colour is produced, which is greatly superior to anything that a Birmingham man can turn out; but, on the other hand, a London workman cannot gild common articles at all nor can he attain his object without a greater expenditure of gold than a Birmingham man. Thus London gilt articles are expensive but good; while those gilt at Birmingham are better in proportion to their price, but they cannot be brought up to the standard attained by the workmen of the metropolis. The modes of their procedure are however essentially the same, the whole of the difference lying in the minor details.

Gilt articles of all the better qualities are submitted to an after-process called colouring, for the purpose of conferring on them a deeper orange tint than is natural to the gold itself, or can be obtained by the process of heightening already mentioned. The principle of this additional operation is always the same, though the methods resorted to differ greatly from each other. One of the most usual is a mixture which contains ingredients and proportions closely resembling the following recipe, though perhaps no two unconnected gilders are precisely uniform in their practice:—Twenty-four parts of nitrate of potash, ten of sulphate of alumina, five of sulphate of iron, and five of sulphate of zinc, are boiled together in water, thoroughly mixed, and cooled without being allowed to crystallize. This mixture is formed into a thin paste with water, which is spread over the surfaces of the articles by their being immersed in it, and when they are placed on a heated iron plate, the warm gold surfaces become oxidized by their contact in that state with the oxygen that forms so large an ingredient in the composition of the saltpetre (nitrate of potash) and of the other salts employed. A mixture is sometimes made of bees' wax and yellow ochre, which being rubbed over the gilt surfaces and burnt off, occasions on a similar principle the same result. Goods that are to appear bright are scratched over before colouring with a brush made of fine brass wire.

Most gilt articles are burnished by a stone burnisher, formed of a polished piece of the mineral known to scientific men by the name of black hæmatite, which is a sort of natural steel, very hard and susceptible of a very high polish. This is fixed into a proper handle. Small articles, as buttons, &c., are placed in a lathe, and the stone applied to them as they revolve, and those that do not admit of this are burnished by hand on a table or bench.

Besides copper and brass, several other substances admit of being gilt.

Silver is gilt in a manner similar to that above described.

Steel and iron are gilt by being immersed in a mixture of the nitro-muriate (or more properly the chloride) of gold with sulphuric æther or alcohol. By combining these liquids together, an alcoholic solution of gold is formed, from which the metal is precipitated by the iron or steel. A patent has lately been taken out for gilding copper and brass by a method which appears to be analogous to this; but though the invention displays considerable knowledge of theoretical and practical chemistry, and much ingenuity in adapting it to this object, there are objections attending its actual practice which will ever prevent its coming into general use.

Ivory may be gilt by immersing it first in a solution of sulphate of iron, and afterwards in one of nitro-muriate of gold.

The edges of the leaves of books are gilt by applying to them a composition of four parts Armenian bole, and one part sugar-candy, ground together with the white of eggs. Gold leaf is afterwards applied, and they are subsequently burnished by the stone.

The gilding of porcelain is accomplished by the application of gold-leaf during the process of its manufacture, which is fixed by that intense heat which confers on this substance its enamel or glaze, and is afterwards burnished by a stone as above described.

Carved wood is gilt by means of the following process:—Some size is dissolved in water by heat, and a little whitening mixed with it. This composition is brushed over the picture-frame or other article to be gilt. The holes and cracks that may be in it are then filled up with a mixture of the same ingredients in different proportions, and of about the consistence of putty. A composition of the same sort, but containing more whitening than the first, is then brushed over it, and allowed to dry. This is repeated till a sufficient thickness has been laid on. The plain parts are then moistened, smoothed down with a Dutch rush, pumice stone, old file, or anything similar, and the corners and mouldings are squared and shaped by proper tools. A composition similar to the last, but in which yellow ochre is substituted for whitening, is then laid on in a thin coat by a brush. This when dry is again covered by a coating of gold size, a peculiar composition, of which deers' fat is said to form the principal ingredient. This is allowed to dry. The frame or other article thus prepared is placed in a sloping position; its parts are successively moistened with water; gold-leaf is laid on them by a 'tip' (a sort of comb formed by inserting a row of camel's hairs into a card), and is pressed down into the cavities by a dry camel's hair pencil. The gold when dry is burnished in the usual manner by a stone.

Another method is to cover the coating of yellow ochre and size with another of oil varnish, and when this is almost dry, or (as it is technically called) 'luggy,' to apply the gold-leaf, which is pressed down into the mouldings by clean cotton. This is afterwards rubbed over with clean cotton to polish it, and when the varnish is quite dry it becomes very hard and solid.

Glass may be gilt by the following simple method:—Dissolve some isinglass in water by means of heat; evaporate the liquid, and allow it to crystallize. Re-dissolve some of the crystals, and after making the mixture of the usual consistence of glue, dip into it a piece of clean chamois leather, which is to be drawn once, and only once, over the parts of the glass that are to be gilt. Lay on the leaf-gold, which will adhere, and allow the whole to dry. On this coating of gold another may be placed in a similar manner, being careful to draw the isinglass only once and lightly over the former coating. It will be generally found advisable to repeat this process a third time. Any superfluous gold may be removed by a sharp stick, and the gilt parts are to be polished by rubbing them with clean cotton, which will obliterate all traces of any joinings, and prevent them from being visible from either side of the glass.

The applications of gold-leaf to leather, paper, wood, and other substances, are numerous and diversified, but what has been said above will be sufficient to indicate the principles and details of this branch of the arts.

GILEAD. [PALESTINE.]

GILLIESIA'CEÆ, a very singular natural order of Endogens, with the habit of the Scilleous division of Liliaceæ, but with extremely remarkable flowers. In the first place there are several bracts at the base of each flower, resembling a calyx, and in reality constituting an involucre; and secondly the calyx is either an urceolate six-toothed body, or a single lobe resembling a labellum. Of the two known genera, one has six perfect stamens, the other has only three perfect and the remainder sterile and nearly obliterated. They are natives of Chili; one of them, Gilliesia graminea, has been figured at folio 992 of the 'Botanical Register,' where a full account of it will be found.

GILLS. [FISH.]

GILLY. [HAINAULT.]

GILLYFLOWER, the common name of the garden stock, Mathiola incana. [MATHIOLA].

GILOLO. [MOLUCCAS.]

GILPIN, BERNARD (born 1517, died 1583), is one of those persons who, without having been placed in stations which afforded the opportunity for the display of extraordinary intellectual powers, or having had the course of their lives marked by very unusual and extraordinary accidents, yet occupy no inconsiderable space in the eye of their countrymen, and are regarded with affection and respect, as ornaments of their time and an honour to the nation to which they belong. This is owing in part to the popular character

of his virtues, and in part to his having had in Bishop Carleton a contemporary biographer, who has given a pleasing and no doubt faithful account of his life and manners. In later times, one of his own family, the Rev. William Gilpin, of Boldre (of whom in the next article), prepared a larger account of this venerable character in his own singularly pleasing style of composition.

Bernard Gilpin was born in Westmoreland, of a genteel family, and by his mother was related to Cuthbert Tunstall, one of the most enlightened churchmen of the time, who being bishop of Durham had the means of placing his relation in the valuable rectory of Houghton-le-Spring, and at the same time giving to the parish a pastor singularly well adapted to the state of society in that parish and its vicinity. But before he became rector of Houghton-le-Spring he had shared in the sufferings of the Protestant clergy. Early in the reign of Queen Mary he resigned a small living in the diocese of Durham, and went abroad, as did many others who had been favourers of the Reformation in the days of King Edward. He was absent three years. He ventured to return while Queen Mary was alive; and was cordially received by Tunstall, who made him archdeacon of Durham and rector of Houghton. His preaching at this period was bold. He inveighed against popular vices in the spirit of an enthusiastic reformer; and when this brought upon him much odium from persons who were touched by him, and he was accused to the bishop of Durham, the bishop protected him so effectually, that his accusers brought their charges before Bonner, the bishop of London, whose memory is held in execration for his insolent behaviour and his needless severities. This led to a remarkable incident. Gilpin obeyed the summons of this unpitying prelate. Full of the expectation of nothing less than to suffer at the stake, 'Give me,' said he, before he set out, to his house-steward, 'a long garment, that I may die with decency.' As he journeyed with the ministers of the bishop, an accident happened to him which occasioned a delay. It is said that his leg was broken. While he lay without the possibility of proceeding, intelligence came that the queen was dead. A change of system instantly took place, and Gilpin returned in joy and peace to his parishioners at Houghton.

The only other incident in his life which requires notice is, that the bishopric of Carlisle was offered to him by Queen Elizabeth. This offer he declined, and continued to his death the rector of Houghton, residing constantly in his parish, except when he visited the ruder parts of the county of Northumberland, into which he appears to have introduced more of regular habits of life and more of Christian influences than had resulted from the labours of any previous Christian instructor who had lived amongst them.

The parts of Redesdale and Tynedale, debatable land on the Marches, are particularly named as the scenes of his labours. The people there, living on the borders of the two countries, had long led a lawless life, subsisting mostly on plunder. Gilpin went fearlessly amongst them, holding forth the commands and the sanctions of Christianity, and did much to change the character of the country. Hence it was that he was often called the Northern Apostle.

His own parish of Houghton however was the chief scene of his labours. It yielded him an ample income, for Houghton was then, as now, one of the richest benefices in the North. He was himself a bachelor. In hospitality he was like what is said or fabled of the primitive bishops. Every fortnight, we are told, forty bushels of corn, twenty bushels of malt, and a whole ox, were consumed in his house, besides ample supplies of provisions of many other kinds. The rectory-house was open to all travellers, and so great was the reverence which surrounded the master, that his liberality was rarely abused; even the most wicked being awed by it.

His skill in according differences was scarcely less famed than his hospitality and his preaching; and when to this we add that his benevolence took the wise direction of providing instruction in human learning for the young, and that he was assiduous in his attention to the sick and to the poor, we have touched upon all the points which can be prominent in the life of a good pastor. His zeal for education was manifested at once in the education of the poor children in his parish in homely learning, and in patronizing promising youth in their studies in the universities. He was sometimes called the Father of the Poor.

Thus this good man lived and died. No one can doubt that he did great good in his day and generation in that remote part of the kingdom; and his memory being so well embalmed, as little can we doubt that his life has influenced many since his time to be faithful and zealous pastors of the church, blessing and blessed of that portion of it which was committed to their charge.

GILPIN, WILLIAM (born 1724, died 1804), was of the same family with Bernard Gilpin, being the sixth in descent from William Gilpin, his elder brother. There was another divine in this family, of not sufficient note to have a place in a general biographical dictionary, yet not wholly to be passed over:—Dr. Richard Gilpin, who resigned the rectory of Greystock, in Cumberland, on non-compliance with the terms of the Act of Uniformity in 1662, and continued a dissenting minister till his death, in 1699. This Dr. Richard Gilpin was the great-grandfather of William Gilpin, whose father, an officer in the army, had a narrow escape from being the military governor of Carlisle, at the time when it was taken by the rebels in 1745, having been shortly before superseded in his command there by an officer sent thither by the duke of Cumberland.

Mr. Gilpin took orders, and lived for some time on a curacy in the north, among his relations; but having only a small fortune, and marrying a young lady, his cousin, whose fortune also was small, and having but little hope of patronage in the church, he removed into the neighbourhood of London, and took a school at Cheam, in Surrey, which he conducted skilfully and successfully for many years. Among his pupils were the present Viscount Sidmouth and Lord Bexley, and the late Colonel Mitford, the author of the History of Greece.

Mr. Gilpin is said, by the friend who has drawn a very pleasing picture of his life and manners, to have resolved to retire from the duties of a schoolmaster whenever he had realized 10,000*l.*; and having at length succeeded in this, he adhered to his resolution, and it happened fortunate for him that at the same time his former pupil, Colonel Mitford, presented him to the living of Boldre, on the borders of the New Forest, Hampshire. To this village Mr. Gilpin retired, and here he spent the remainder of his life, scarcely ever leaving it, in the active discharge of the duties of a village pastor, and being, like his venerable ancestor, a blessing to the place. Here he died on April 5, 1804, at age of eighty, and is buried in the churchyard, where also lies his widow, who survived him three years, 'hoping to be raised in God's good time, when it will be a new joy to see several of their good neighbours who now lie scattered in those sacred precincts around them.'

Mr. Gilpin however is not to be regarded only in his character of a good schoolmaster and an excellent parish pastor; he has enriched the literature of his country with several valuable writings in various departments. His first work was a 'Life of Bernard Gilpin,' and it was soon succeeded by a 'Life of Latimer,' who bore some resemblance to Gilpin. At a later period of life he published lives of Cranmer, Wickliff, Huss, Jerome of Prague, and Zisca. He was the author also of a body of 'Lectures on the Church Catechism,' an 'Exposition on the New Testament,' a 'Treatise on the Amusements of Clergymen,' and 'Sermons for Country Congregations.' These works are all written in a style of simplicity which is singularly engaging.

But Mr. Gilpin was a person of a remarkably refined taste, as is evinced by writings of his of a class entirely distinct from those we have enumerated. These are his volumes in which he has illustrated, both by his pencil and his pen, the picturesque beauty of some parts of England, and, generally, the principles of beauty in landscape. The first of these works was published in 1790, in two volumes, 8vo.; it was entitled 'Observations relative chiefly to Picturesque Beauty, made in the year 1776, in several parts of Great Britain, particularly the Highlands of Scotland.' This was followed by two other volumes of the same character, the greater part of them relating to the lake country of Cumberland and Westmoreland. Two volumes more, on 'Forest Scenery,' succeeded. Besides these, there are his 'Essays on Picturesque Beauty;' 'Picturesque Travels and the Art of Sketching Landscapes;' 'Observations on the River Wye;' and 'Picturesque Remarks on the Western parts of England.' These form a body of works which were well received by the public at the times of their appearance, and which are now gathered into the libraries of the tasteful and the curious, so that copies rarely present themselves for public sale. One work more of Mr. Gilpin's must be named, his 'Essay on Prints,' in which he did not

profess to do more than touch on the more prominent points of his subject. Some 'Observations on the Coasts of Hampshire, Sussex, and Kent,' were published after his decease.

For the principal part of this article we have been indebted to a memoir on his life inserted in a periodical work published at Bath, and intitled 'The Omnium Gatherum.' It contains much more information concerning him, and extracts from his correspondence. The writer is understood to be the Rev. Richard Warner, who was sometime curate to Mr. Gilpin.

GIN, a spirituous liquor prepared by the rectifying distillers of England by means of flavouring ingredients added during the rectification of spirit distilled from barley. [DISTILLATION.] The name Gin is derived from that given in this country to the spirit imported from Holland, viz. Hollands-Geneva, which was formerly much consumed in this country, but the use of which has during the last forty years been nearly discontinued in favour of British gin, made in imitation of the Dutch spirit. The principal flavouring ingredient used both in Holland and in England, the only one indeed, the employment of which is acknowledged by the rectifiers, is the juniper-berry. Gin is principally consumed by the working classes in England; and its use does not extend to Scotland or Ireland, in both which parts of the kingdom its place is supplied by whiskey.

GIN. [COTTON.]

GINGER. [ZINGIBER.]

GINGUENÉ, PIERRE LOUIS, born at Rennes in Britanny, in 1748, early applied himself to the study of literature and of foreign languages. Having removed to Paris he made himself known by several works, especially by his poem on the death of the young Prince Leopold of Brunswick, who was drowned in the Oder whilst trying to save some poor people who were in danger of perishing in the flood. In his 'Lettres sur les Confessions de J. J. Rousseau,' he undertook to defend the memory of that highly-gifted but wayward man. When the Revolution broke out, Ginguené embraced its cause, but did not advocate its excesses; he wrote in several journals of the time, and edited the 'Decade Philosophique Littéraire et Politique,' from 1794 to 1807. On being made a member of the Institut, he was placed at the head of the department of public instruction. He was afterwards sent by the Directory in 1798 as ambassador to the king of Sardinia, where he had a most difficult task to perform, that of reconciling his conscience, naturally honest and candid, with the crooked and ungenerous policy of his masters towards a forced ally, whom they tried to vex and insult in every possible manner, with the view of seizing a favourable opportunity to dethrone him. Botta, who knew and esteemed Ginguené, gives in his 'History of Italy' a full account of disgraceful and calamitous scenes that took place in Piedmont at the time. Ginguené seems to have felt the unpleasantness of his position, for after seven months he resigned his embassy and returned to Paris, where he had a seat in the legislative body. After Bonaparte became first consul in 1799, Ginguené was chosen member of the tribunate, but owing to his opposition to the encroachments of the executive he was one of those who were ejected by a Senatus Consultum in 1802. He withdrew into private life, and applied himself chiefly to the composition of a work which he made the business of the remainder of his life—the 'Histoire Littéraire d' Italie,' 9 vols. 8vo., 1811-19.

He had always been very partial to Italian literature, and perceiving that his countrymen had no accurate notion of its riches and had imbibed several vulgar prejudices against it, he undertook the arduous task of classing the numerous productions of Italy under each respective department of literature and according to the order of time, thus presenting the reader with so many sketches of the intellectual state of Italy in each century. His history begins, properly speaking, with the thirteenth century, when the first lays of the Italian Muse began to be heard. In the first three volumes he follows the progress of literature through the thirteenth, fourteenth, and fifteenth centuries; after which he devotes six more volumes to the sixteenth century, the Augustan age of modern Italy. He died at Paris in November, 1816, without completing his work, which has since been continued by Salfi, who has published five more volumes, 1823-35, bringing it down to the close of the seventeenth century. It is an important and useful work, and in some respects preferable, because more critical and more freely written, to Tiraboschi's more ample and classical work, 'Storia della Letteratura Italiana,' from which Ginguené borrowed largely. Ginguené writes impartially, and as accurately as could be expected from a foreigner who had not lived in Italy, except during the seven stormy months which he spent at Turin, merely on the threshold of that country. His minuteness is sometimes fatiguing, and his style rather tame for the subject. The Italians have felt grateful to him for the honour which he has done to their great men, but have observed that he has been lavish of praise to many writers who are utterly forgotten in their own country. (Ugoni, Preface to the *Storia della Letteratura Italiana.*) Valéry, in his 'Voyages Littéraires en Italie,' corrects several inaccuracies of Ginguené.

Ginguené had collected a good library of Italian writers for his great work, of which a catalogue has been published, and which was sold after his death. He wrote also many articles for the 'Biographie Universelle,' and was a contributor to the 'Histoire Littéraire de France,' and other compilations. Salfi gives at the end of the first volume of his continuation, which is numbered the tenth of the 'Histoire Littéraire d'Italie,' an 'Eloge' of Ginguené.

GINKELL. [ATHLONE.]

GINSENG, a root found in China, to which extraordinary properties have been ascribed; it is not only considered a universal remedy for all maladies, but is spoken of in the highest terms as a specific in particular circumstances. Volumes have been written in Chinese upon the supposed virtues of this root; it is affirmed that it wards off fatigue, invigorates the enfeebled frame, restores the exhausted animal powers, makes old people young, and so on. The weight in gold has been given by the Chinese for this root, which we are told grows only in the most remote and inaccessible parts of Chinese Tartary, where its collection is attended by dangers sufficient to appal the stoutest man. Nevertheless botanists believe the Ginseng to be nothing more than a plant called Panax quinquefolium, also found in North America, where no such qualities as those spoken of by the Chinese are recognised. It is however not certain that this identification is correct; indeed it is hardly to be supposed that such extraordinary faith in the energies of the plant can be altogether destitute of foundation. Nothing better deserves scientific investigation.

GIO'JA, MELCHIO'RRE, born at Piacenza in 1767, studied in the college Alberoni of that town, after which he was ordained priest. He showed at an early age a predilection for the mathematical sciences. When Bonaparte invaded Lombardy in 1796, Gioja went to live at Milan, adopted republican opinions, and became a political writer. The Provisional Government at Milan having offered a prize for the solution of the question, 'Which of the various forms of free government is best suited to Italy?' Gioja obtained the prize. He advocated a constitution on the model of the French one of 1795, with two elective Chambers, an executive Directory, &c., but with some modifications, by which he really believed that the establishment of liberty and political equality would be secured. The result proved unfavourable; the Cisalpine Republic, a mere dependant of France, after changing its constitution two or three times in as many years, fell before the arms of Austria and Russia in 1799. It is but justice to say that during this turbulent period Gioja wrote the following pamphlets, chiefly in reproof of fanatical or dishonest revolutionists who advised measures of confiscation and proscription against all those whose opinions were different from their own:—1. 'Quadro Politico di Milano.' 2. 'Cosa è Patriotismo?' 3. 'I Partiti chiamati all' Ordine.' 4. 'La Causa di Dio e degli Uomini difesa dagl' Insulti degli Empj e dalle Pretensioni dei Fanatici.' All these are curious memorials of the aberrations of opinion in those times. Gioja, after being imprisoned as a republican in 1799, was liberated in 1800, after the battle of Marengo. He now applied himself chiefly to political economy, and it is upon his works on that science that his reputation is founded. He wrote, in favour of a free trade in corn and other provisions, 'Sul Commercio dei Comestibili, e caro prezzo del vitto,' Milan, 1801. The price of bread continued however to be fixed for years after by the municipal authorities in the towns of Lombardy His description of the department dell' Olona, or of Milan, and of that del Lario, or of Como, was considered as a model for statistical works. When Napoleon crowned himself king of Italy, Gioja resumed his political pamphlets, and wrote, 'I Tedeschi, i Francesi, e i Russi in Lombardia,' in which he maintained that the dominion of the French

was more congenial to Italy than that of the other two. He was soon after appointed historiographer of the kingdom.

Gioja's reputation rests on his 'Nuovo Prospetto delle Scienze Economiche,' 6 vols. 4to., Milan, 1815-17; a work of considerable research and labour, in which the author has collected and examined the opinions of most economists, Italian and foreign, and tried them by a comparison with the historical facts and institutions of various nations, antient and modern. The greater part of the work is in a tabular form, the tables being furnished with quotations and notes. Gioja prefers large properties to subdivided ones, arts and manufactures to agriculture, and he advocates the principle of association as a powerful means of production; he is also in favour of a system of universal popular education. At the end of the sixth volume he gives a list of cases in which the interference of the government may be useful to industry, and another of those in which it is mischievous. As a sequel to this work he published a treatise, 'Del Merito e delle Ricompense,' 2 vols. 4to., 1818-19, a work full of bold and original ideas, many of which may be highly useful, whilst others appear impracticable in the present state of society. In it the author exhibits a total independence of all political systems, very different in this respect from his former political productions. He strives to ascertain and fix a standard for the various kinds of merit or value, physical, intellectual, and accidental, of men, and to point out the authority which is to estimate the same. This last subject engrosses a chapter which is perhaps the most curious in the whole work. Few of the advocates of the political rights of the people have openly faced the question of the capabilities of the majority of that people for exercising those rights. Gioja has not shrunk from the thankless task. This chapter, iii. of book I., on the judgment of the people assembled for the purpose of election, is divided into the following heads:—1. Knowledge required in the people for making a proper choice of public functionaries. 2. Will of the people in making a choice. 3. Power or means of the people to accomplish the same object. Gioja cites opinions and facts both favourable and unfavourable under each head, and then draws his own inferences—that the masses of the people are easily deceived by sophistry and false appearances; that they are led astray by those who know how to flatter their vanity and their envy against the rich; that they generally prefer rash advice to slow and discriminating counsels; that they are apt to run from one extreme to the other; that when excited by fanaticism, compassion, or fear, they become cruel and ferocious, while in quiet times they are indolent and careless, or open to bribes; that they are likely to adopt the most unjust course in the hope of having provisions cheap. He urges therefore the necessity of restricting the number of electors by means of qualifications of age, income, and civil and moral requisites. He insists chiefly on the qualification of mature age in the electors, whilst in the candidates for legislative functions he requires principally knowledge and morality, which he thinks might be ascertained by authentic documents. Book II. treats of the various kinds of rewards for the different degrees of civic merit; and he combats Bentham and Condorcet, who assert that virtue needs no reward. Gioja says in his preface, that the first idea of his subject was broached by Dragonetti, a Neapolitan writer, in 1765, in a small pamphlet, 'Della Virtù e dei Premj;' that afterwards Diderot, in his 'Essai sur le Mérite et la Vertu,' lost himself in metaphysical abstractions; and lastly, Bentham, in his 'Théorie des Peines et des Récompenses,' edited by Dumont in 1811, worked upon the idea of Dragonetti, but embraced only a small portion of the subject, and engrafted upon it several errors, which he (Gioja) refutes in his book.

Gioja's work, 'Dell' Ingiuria e dei Danni e del Soddisfacimento,' 2 vols. 8vo., 1821, is a kind of penal code, the main principle of which is compensation to the injured person. He proposes to fix a scale applicable to various cases, keeping in view chiefly the respective circumstances of the offender and of the offended. The principle of the author appears just, though the carrying of it into effect is subject to many difficulties. A good notice of the work is given in the *Biblioteca Italiana*, for December, 1821. Gioja wrote also a 'Treatise on Ideology,' 'Elements of Philosophy,' 'Il Nuovo Galateo,' or a treatise on good manners, and other works, among which the 'Filosofia della Statistica,' 2 vols. 1826-7, deserves especial mention. The first book treats of physical geography and its various branches, in which he includes climate; the second, of the population as affected by the physical character of the country; afterwards the movement of the population, its number, births, marriages, and deaths; the physical character of the people, their food, their habits and occupations; the third, of the productions of countries, vegetable, animal, and mineral. The work is highly interesting, and deserves an attentive perusal. Gioja died at Milan, in January, 1829. His remains were followed to the grave by his disciples and friends. With some eccentricities of temper, he was a most remarkable man for logical perspicuity, vastness of information, and indefatigable labour. He ranks among the very first writers on political economy that Italy has produced. (Pecchio, *Degli Economisti Italiani*; Romagnoli published a biographical notice of Gioja in the *Biblioteca Italiana*, No. 156.)

GIOJA. [COMPASS.]

GIORDA'NO, LUCA, called Luca fa presto, 1629—1705. The above dates of the birth and death of this eminent painter are those given by Velasco, which seem the most authentic; but authors differ about both dates. He was born at Naples, where he studied painting under Ribera, better known by the name of Spagnoletto. He afterwards went to Rome, where he became a pupil of Pietro da Cortona, and assisted him in many of his great works. Leaving Rome he repaired to Lombardy to study Correggio and then to Venice, to acquire a knowledge of the composition and colouring of the great Venetian artists. These various studies not only impressed on his mind a vivid idea of the style of every eminent master, but, as he had great readiness of hand, enabled him to imitate them so closely as to deceive even experienced connoisseurs. He had not only a fertile and fine imagination, but such a rapidity of execution that the number of great works executed by him is astonishing. It was not from this circumstance however that he derived the name of Fa Presto, but from the avarice of his father, who at the beginning of Luca's career sold at a high price his designs after the works of the great masters, and was continually urging him at meals as well as at work by saying 'Luca, fa presto' (Luca, make haste), which his companions gave him as a nickname. After his return to Naples he was very much employed there, till in 1679 he was invited by Charles II., king of Spain, to adorn the Escurial. He accordingly went to Madrid, where his polished manners, cheerful temper, and lively wit, in addition to his talents as an artist, gained him the favour of the court, where he remained till the death of Charles II., when he returned to his own country. His colouring was agreeable, his designs were spirited and ingenious, and his drawing, when he allowed himself time, correct; but from the rapidity with which he proceeded, his works are often deficient in the last particular. His best works are his frescoes, in the Escurial at Madrid, at Florence, and at Rome. Some of his finest pictures are at Dresden. The grand altar-piece in the Church of the Ascension at Naples, representing the Battle of the Angels and the Fall of Lucifer, is considered as one of his finest performances.

GIORGIO'NE DI CASTELFRANCO (Giorgio Barbarelli, called) one of the most distinguished artists of the Venetian school, was born in 1477 at Castelfranco, in the Trevisano. He received his education at Venice, where he at first devoted himself to music, and became an excellent performer on the lute. He however soon applied to painting, and became the disciple of Giovanni Bellini, whose minuteness of manner he speedily rejected, and adopted a much freer style, distinguished by bold fore-shortening, ample outlines, dignity and animation, breadth of drapery, richness of accompaniment, a more natural and softer gradation of tints, and forcible effects of chiaro-scuro. This last had indeed been already practised by Lionardo da Vinci, but there appears to be no solid ground for the assertion of Vasari, that Giorgione was indebted for his chiaro-scuro to some paintings or drawings by Lionardo. In the school of Bellini he had Titian for one of his fellow-pupils, who at a subsequent period of their lives was so struck with the style and colouring of Giorgione, that, as some writers affirm, he became his pupil, but it appears more probable that he cultivated an intimacy with him, which was ended by the jealousy of Giorgione, who saw that his friend was becoming a formidable rival. His greatest works were in fresco, and he adorned the fronts of many large buildings in Venice with admirable works, of which nothing now remains. He painted however many oil pictures, which are distinguished by vigorous *impasto* and fulness of pencil. His portraits, says an eminent artist, have every excellence

which mind, dignity, truth, freshness, and contrast can confer; he sometimes used ruddy sanguine tints, but on the whole they are marked by simplicity. His historical pieces are few, and as he died so young, they are of course scarce and highly valued. 'Christ allaying the Storm,' in the school of St. Mark at Venice, appears to have been the most considerable of his historical compositions. The 'Finding of Moses,' in the Archiepiscopal palace of Milan, and 'Christ bearing the Cross,' at Venice, have been looked upon as his master-pieces. He died at Venice, during the plague, in 1511, at the age of thirty-three years.

GIOTTO (properly Ambrogiotto Bondone), born in 1276, in the district of Vespignano, near Florence, was the son of a simple peasant, and followed his father's occupation. In the half idle employment of tending the sheep in the fields, he used to amuse himself by sketching figures, and being once found by Cimabue drawing a sheep with a sharp stone on a piece of slate, this artist was so struck with the performance that he asked Giotto's father to entrust his son to him. He took him to Florence, where he instructed him in painting (in fresco or distemper, oil painting not being yet discovered). Giotto applied with great diligence to the art, and fully realised the anticipation of his master, whom he soon excelled. He first freed art from the dry Gothic manner which then prevailed, and gave expression and action to his figures. He was distinguished above all his contemporaries by nobler forms, a pleasing disposition of his figures, the broad majestic folds of his draperies, and especially by a gracefulness which remained unequalled till the appearance of Masaccio. It seems likely that he was partly indebted for his superiority to the study of the antique, with which he might have become acquainted at Florence, and afterwards at Rome; and it is the more probable, as we know that he was also an architect and sculptor, and that models of his still existed in the time of Lorenzo Ghiberti. His reputation spread throughout Italy, many cities of which are adorned with his works. The greatest proof of his powers was the once celebrated mosaic of the Navicella, or boat of St. Peter, placed over the grand entrance of the church at Rome; but it has undergone so many alterations that it now affords little evidence of his talents, which however we may judge of by his still remaining works at Florence, in the coronation of the Virgin, in the church of Santa Croce, the entombment of the Virgin, at Assisi, and in the history of St. Francis, in the Sacro Convento. He may also be called the restorer of portrait painting, and has, together with the features, given the air and character of Dante, Brunetto Latini, and Donati, the first of whom mentions him in his poems. He was a man of genius and knowledge, pleasant in conversation, and fond of poetry. Boccaccio and Sacchetti often mention him in their novels, and record his witty sayings; and Petrarch speaks of him in his letters. He went with Pope Clement V. to France, where he executed many fresco paintings. He died in 1336. [CAMPANILE.]

GIO'VIO (JOVIUS) PAUL, was born in 1483, of a noble family of Como, and studied in the universities of Padua and Pavia. He was intended by his relatives for the medical profession, which however he forsook to devote himself to literature; and he applied himself to the study of the Roman classics, with a view to form his style in that language. Having repaired to Rome, soon after the election of Leo X., he found means to be introduced to him and to show him some of his compositions, and from that moment the pope became his patron. He was attached to the suite of Cardinal Giulio de'Medici, afterwards Clement VII., and followed him in various missions. He remained at the court of Rome after Clement ascended the papal throne, and witnessed the pillage of that city by the Imperial troops. After the restoration of peace, Clement bestowed on him the bishopric of Nocera, where he never resided, but entrusted the charge of his see to a coadjutor. He was present at the famous conference of Bologna between Charles V. and Clement VII., in 1530, and was favourably noticed by the emperor, who gave him a circumstantial account of his expedition to Tunis, to be inserted in the history which Giovio was then writing. When Paul III. became pope, Giovio fell into a sort of disgrace, that Pope being zealous concerning ecclesiastical discipline, in which the bishop of Nocera was a latitudinarian, both in his conduct and writings. (See his *Lettere.*) He was accused by satirical poets of every sort of licentiousness, and was also charged with infidelity and atheism. There was malignity as well as exaggeration in this, but Giovio was certainly not a pattern of clerical modesty or piety. On withdrawing to his native Como, he built himself a delightful country residence, which he fancied, though erroneously, to be on the site of one of Pliny's villas. Here he collected a museum and a gallery of portraits of the most distinguished men of his own and former ages. He spent his time partly at his villa and partly in visiting various courts of Italy, in which he was received with marked attention. He was himself a courtier by temper and habit; his conversation was humorous, and he had always some flattery ready for the great. The facetious Berni, in his 'Orlando,' has pourtrayed Giovio to the life, under the name of Feradotto, at the court of King Gradasso. In one of his visits to Florence Giovio was seized with a violent fit of the gout, of which he died in December, 1552, and was buried in the church of St. Lorenzo, where a statue was raised to his memory. He died rich, for he enjoyed several ecclesiastical benefices, besides pensions and presents from various princes.

Giovio left the following works:—1. 'Historiæ sui Temporis,' 2 vols. fol., 1550. This history is not to be trusted implicitly, for the author's pen was always at the service of his patrons and friends. 2. 'Illustrium Virorum Vitæ,' fol., 1551: a work much superior both for truth and eloquence to the first. In it the author draws the portraits of Leo X., Adrian VI., Cardinal Prospero Colonna, the Marquis Pescara, Gonsalvo of Cordova, Duke Alfonso I. of Ferrara. Blount, in his 'Censura Celebriorum Authorum,' and Thomas, in his 'Essai sur les Eloges,' highly praise Giovio's biographies. 3. 'Libellus de Piscibus Romanis.' He wrote in Italian: 4. 'Commentario delle Cose dei Turchi.' 5. 'Dialogo delle Imprese,' which is a treatise on the devices or symbols adopted by the knights in the times of chivalry, and which were the origin of our coats of arms or heraldic signs. A collection of Letters of Giovio was published after his death, 'Lettere Volgari,' 8vo., Venice, 1560. Some of his facetious epistles are found in the collection of Atanagi, Venice, 1561. His letters contain much literary and historical information concerning that age, and are worthy of perusal. One of his descendants, who died in our time, Count Giovan Battista Giovio, has written a copious panegyrical notice of Paolo Giovio.

GIPSIES, a word corrupted from Egyptians, is the name given in England to a wandering race of people who are found scattered over many countries of Europe, whither they migrated from the East about the beginning of the fifteenth century. Pasquier, in his 'Recherches Historiques,' says that they first appeared at Paris in the character of penitents, or pilgrims, in August, 1427, in a troop of more than 100, under some chiefs who styled themselves counts, and that they represented themselves as Christians driven out of Egypt by the Mussulmans. They obtained permission to remain in the kingdom; other troops followed, and they wandered about in all directions, unmolested for many years, committing petty depredations, and their women assuming the calling of fortune-tellers. In 1560 an ordonnance of the states of Orléans enjoined all impostors and vagabonds styled 'Bohemians,' or 'Egyptians,' to quit the kingdom under pain of the galleys. The name of Bohemians, given to them by the French, may be owing to the circumstance of some of them having come to France from Bohemia, for they are mentioned as having appeared in various parts of Germany previous to their entering France: others derive the word from 'Boëm,' an old French word signifying a sorcerer. (Moreri, art. *Bohemiens*; and Ducange's 'Glossary,' art. *Ægyptiaci*.) The Germans gave them the name of 'Zigeuner,' or wanderers; the Dutch called them 'Heiden,' or heathens; the Danes and Swedes 'Tartars.' In Italy they are called 'Zingari;' in Turkey and the Levant 'Tchingenes;' in Spain they are called 'Gitanos;' in Hungary and Transylvania, where they are very numerous, they are called 'Pharaoh Nepek,' or 'Pharaoh's people.' The notion of their being Egyptians is probably derived from the circumstance that many of them came immediately from Egypt into Europe, but it seems proved that they are not originally from that country, their appearance, manners, and language being totally different from those of either the Copts or Fellahs. There are many gipsies now in Egypt, but they are looked upon as strangers, as indeed they are everywhere else.

It is now generally believed that the gipsies migrated originally from India at the time of the great Mohammedan invasion of Timur Beg; that in their own country they belonged to one of the lowest castes, which resemble them in their appearance, habits, and especially in their fondness

for carrion and other unclean food. Pottinger, in his 'Travels,' saw some tribes resembling them in Beloochistan. There is a tribe near the mouths of the Indus called Tchinganes.

The gipsies, in their language, call themselves Sind; and their language has been found to resemble some of the dialects of India. (*Bombay Transactions*, 1820.) They have no traditions or records concerning their origin; no religion of their own, but they adopt the outward forms of the people among whom they live, whether Christians or Mussulmans. Everywhere they exhibit the same roving habits, a dislike to a fixed settlement and to the arts of husbandry, uncleanness in their food, licentiousness, ignorance and intellectual apathy, a disposition to pilfer, and to impose on the credulity of others. They seldom commit violent robbery or other heinous crimes, being fearful of punishment. Maria Theresa ordered those in her states to be instructed in agriculture, with a view to their permanent settlement; but her endeavours were not very successful. In Hungary and Transylvania however many of them follow some regular trade and have fixed habitations; they wash gold from the sand of the rivers, and they work iron or copper; some are carpenters and turners, others are horse-dealers, and even keep wine-shops or public-houses. They abound in Wallachia, Moldavia, and Bessarabia, and they are found in Russia as far as Tobolsk. Grellman, in his 'Versuch über die Zigeuner,' Göttingen, 1787, conjectures that there are between 700,000 and 800,000 in Europe, of whom 40,000 are in Spain, chiefly in the southern provinces. In England they have much diminished of late years in consequence of the inclosure of land and the laws against vagrants. J. Hoyland has collected the most accurate information that could be procured concerning this strange race, in his *Historical Survey of the Customs, Habits, and present State of the Gypsies; designed to develop the Origin of this Singular People, and to promote the Amelioration of their Condition*, 8vo., York, 1816. He has largely made use of the work of Grellman.

GIRAFFE, CAMELOPA'RDALIS (*Giraffa* of Brisson, Camelopard of Pennant and authors), a genus of Ruminants, with persistent horns common to both sexes, comprising the tallest of the known quadrupeds.

Organization.

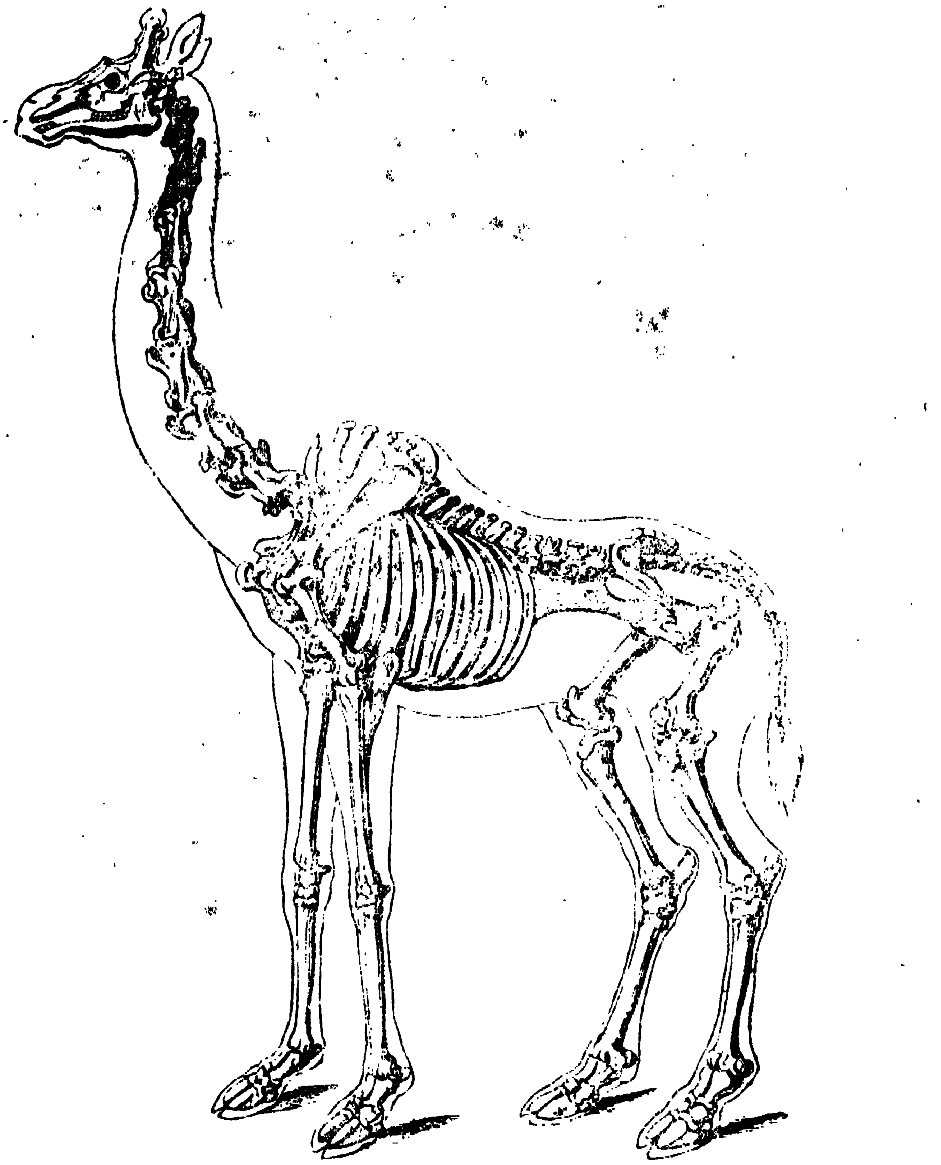
The skeleton of a Giraffe arrests the attention of the observer at once:—the head lifted on high upon the extremely elongated neck, the high withers, and the slender length of limb, taken together contrast strangely with the bony fabrics of the other quadrupeds. A man who looks up at such a skeleton for the first time, and without previous knowledge of its structure, must be struck at finding that the towering neck consists of exactly the same number of bones that form his own. The skull is light and thin. The horns are considered by Dr. Rüppell (who, during his travels in Northern Africa, obtained in Nubia and Kordofan three specimens, two males and one female) as constituting the principal generic character, they being formed by distinct bones, united to the frontal and parietal bones by a very obvious suture, and exhibiting throughout the same structure as the other bones. In both sexes, he observes, one of these abnormal bones is situated on each branch of the coronal suture, and the male possesses an additional one, placed more anteriorly and occupying the middle of the frontal suture. The existence of this third appendage is considered to furnish a complete refutation of Camper's theory with regard to the *Unicorn*, viz. that such an occurrence is contrary to nature, and to prove at least the possibility of the existence of such an animal. This appendage is conspicuous in the plate containing the crania (*Atlas zu der Reise im Nördlichen Afrika*, von Eduard Rüppell,—Pl. 9, fig. *a, a*), and, as it is there represented, rises abruptly from the os frontis with all the appearance of a third horn. Cuvier, in his last edition of the 'Règne Animal' (1829), follows Dr. Rüppell, and, speaking of the horns, says, their bony core (noyau osseux) is articulated in youth by a suture on the frontal bone. In the middle of the chanfrein is a tubercle, or a third horn, larger and much shorter but equally articulated by suture.

The well-known accuracy of Dr. Rüppell demands every degree of respect; and if the figure alluded to be a correct representation of the ordinary state of the adult Nubian male Giraffe, and not an accidental deformity, the third

Skull of male Giraffe, from Rüppell's figure.

horn would form a good ground for specific distinction. There are skulls of the Cape Giraffe, both male and female, in the Museum of the College of Surgeons; and that of the male, which is an adult with the persistent teeth, has no such horn; but there is a considerable gradually-rising protuberance, which is more strongly developed than the same part in the female cranium. In all the crania which we have seen, and in all the living specimens, the females possess this protuberance as well as the males, though not in so high a degree of development; and the true horns, at least the bony cores, are much larger in the male than in the female. It may be said that the living and dead specimens which we have lately received from North Africa are comparatively young; though some of them are not so very young. The three Giraffes now (1838) living in the garden of the Zoological Society at the Regent's Park are advancing fast towards their full growth, and in all of them the protuberance will be seen; though that of the female is not quite so highly marked perhaps as those of the males. But Mr. Owen, in his paper read before the Zoological Society of London on the 23rd of January, 1838, wherein he entered into the highly interesting details which the dissection of three Nubian Giraffes* had enabled him to demonstrate, shows that this middle protuberance arising from the head is not a true horn, articulated by a suture; but merely a thickening of the os frontis. This position Mr. Owen is enabled to lay down from the section of the skull of a male (Northern) Giraffe, and from the examination of various crania of both Nubian and Cape (male and female) old and young Giraffes. There appears to be no evidence to lead to the conclusion that there is anything at any time in this part of the structure naturally, that can be considered more than a mere frontal protuberance occasioned by the thickening of the bone, a protuberance which will not separate upon maceration, as the two horns will, in the young animal at least. The lightness of the cranium is owing in great measure to the sinuses, which are minutely described by Mr. Owen in his paper; these run along the whole upper part of the cranium, and the occiput is raised by their extension. Mr. Owen shows that a principal object of these sinuses is to increase the surface of the attachment of the ligament supporting the head, and draws attention to the remarkable vertical extension of the condyles of the occiput, a structure which enables the animal to tilt its head back, and gracefully and easily to raise it till it is on a line with the neck. The reader will find the section of the head above alluded to in the Museum of the Royal College of Surgeons, numbered 965 (Osteological Series). In the same museum he will find entire crania of the Cape Giraffe (male and female), with other detached bony parts, and the most perfect and beautiful skeleton of the Nubian Giraffe we have ever seen, though it is that of a comparatively young animal. The position and appearance of the elastic cartilages on the posterior edges of the scapulæ are here exhibited, a beautiful provision for the easy springy carriage of the body, which is principally suspended from the muscles there attached, and slung as it were between these points and the sternal and lumbar regions. In the British Museum are two crania presented by Mr. Burchell. The next best skeleton of a Giraffe known to us in this country is that in the museum of the Zoological Society of London, prepared from the individual which was in the possession of King George IV. at Windsor.

* Two males and one female; all with deciduous teeth.



f Giraffe; the curved outline from the posterior edge of the scapula shows the position of the elastic cartilage above alluded to.

Mr. Owen found the ligamentum nuchæ immense, consisting of two bilateral moieties; it commences at the sacrum, gains fresh accessions from each dorsal vetebra, the spines of which are remarkably elongated for that purpose, is inserted into all the cervical vertebræ, with the exception of the atlas, and attached to the extended surfaces of the occipital region of the skull produced by the organization above alluded to. Before we proceed to notice the softer parts we must refer to the dentition, which offers the same formula as that charcteristic of the deer, goat, antelope, sheep, and ox, viz., incisives $\frac{0}{8}$, canines 0, molars $\frac{6-6}{6-6} = 32$. In the 'Nova Acta Physico-medica Academiæ Cæsareæ Leopoldino-Carolinæ Naturæ Curiosorum,' tom. xii., part 1, is a paper by Dr. D'Alton on the teeth of the Giraffe, written, it should seem, principally with a view to correct the notion apparently entertained by Dr. Bojanus in a preceding paper in the same part, not only that the dentition of the Merycotherium has certain points indicatory of that animal being intermediate between the camels and the sheep, 'camelinum inter et ovillum genus,' but that it might possibly be the Giraffe. Dr. D'Alton figures the teeth of the latter, and shows, by a comparison with those of the Merycotherium, their discrepancy both in size and structure from those of the fossil animal.

The tongue of the Giraffes requires particular notice. Sir Everard Home remarks, that besides being the organ of taste, it has many properties of the proboscis of the elephant, one being an elongation of the organ of smell, the other of taste. The proboscis is incapable of elongation, he observes, beyond one inch in extent, in consequence of its cartilaginous tubes; while the tongue may be extended to seventeen inches after death, and can in the living body lie so diminished in size as to be inclosed within the animal's mouth.

Some mechanism, he remarks, must exist by which this elongation may be performed, as in the tongue of the reindeer: but he states that a post mortem examination would be necessary to decide this. He notices the organ as being very smooth; that is, it is smooth when the papillæ are not raised, as they can be at pleasure, but rougher when they are, and slightly adhesive: it is spotted, but the sp[ots are] not raised, and there is a black rete mucosum, to prevent, as he thinks, the surface from being blistered by exposure to the sun. 'In the absence of an opportunity,' continues Sir Everard, 'of examining the internal structure of the Xariffa's tongue after death, I was led to the opinion that the change of size is effected by the organ containing a reservoir, out of the course of the circulation, which can be filled with blood at the will of the animal, so as to give it rigidity, and enable it to extend itself for the performance of the different actions in which it is employed with the smallest possible degree of muscular exertion. It occurred to me at the same time, that whatever construction may be the means by which the Xariffa's tongue is able to apply itself to such various purposes, whether that which appeared to me probable, or any other, something similar would be met with in other animals, particularly in the tongue of the deer, which, after death, readily admits of being drawn out to the extent of eight inches, although when immersed in rectified spirits it contracts to five inches. For the purpose of such an examination, a deer's tongue, recently after the animal's

death, was injected with minute red injection, so as to distend the arteries and show the course of the circulation in them to the greatest advantage. This tongue was afterwards divided longitudinally in a perpendicular direction, also in a horizontal one, to show the muscles of which it is composed, as well as the other parts that it contained.' From this examination, the structure of the tongue of quadrupeds in general is described by Sir Everard as being longitudinally divided into two equal portions by a middle line; the muscular structure occupies the whole of the interior substance, receiving a large supply of nerves and blood-vessels from a lateral nerve and artery that pass along the outer edge; these are imbedded in a very loose cellular tissue, the texture of which admits of the blood-vessels being distended to a very great degree, so as to enlarge the volume of the tongue; and beyond this tissue, surrounding and forming a case for the whole of the upper and lateral part of the organ, is a strong very elastic covering of some thickness, which yields when the muscles and the trunks of the arteries are distended with blood, so as to give both extent and rigidity to the organ, and admit of the different actions in which it is employed. Sir Everard then adds, that there can be no doubt of the structure of the Xariffa's tongue being the same; its actions depending upon the combined powers of muscular contraction and elasticity; its increase and diminution of size arising from the blood-vessels being at one time loaded with blood and at another empty.

The chief modification in the muscles of the tongue is in those destined to retract it. Mr. Owen, in a note to his edition of 'Hunter's Animal Œconomy' (8vo., London, 1837), says, 'a most beautiful and forcible example of the use of tendon in limiting the length of a muscle to the extent of motion required to be produced in the part to be moved occurs in the sterno-thyroidei of the Giraffe. Had these muscles been continued fleshy as usual from their origin, through the whole length of the neck to their insertion, it is obvious that a great proportion of the muscular fibres would have been useless, because such a condition of the muscle would have been equal to have drawn down the larynx and os hyoides more than one-third of the extent of the neck, which is neither required nor permitted by the mechanical attachments of the parts. The sterno-thyroidei therefore proceed from the head of the sternum blended together in one fleshy fasciculus for about nine inches, and end in a tendon which is continued for six inches; this then divides, and the muscles proceed again fleshy for about sixteen inches, when a second tendon intervenes in each between the preceding and the next fleshy portion, which is finally inserted into the thyroid cartilage, and, by a continued fascia into the os hyoides: thus the quantity of contractile fibre is proportioned to the required extent of motion by intervening tendons; the sterno-hyoidei being wanting, or their place supplied by the sterno-thyroidei, as in some other ruminants. The analogue of the omo-hyoideus is in the same animal adjusted to its office by a different and more simple modification; its origin is removed from the shoulder-blade to the nearest point (the third cervical vertebra), from which it could act with the requisite force and extent upon the os hyoides.

Sir Everard Home fancied that the Giraffe on which he made his observations, the individual belonging to George IV., preferred licking the hand of a lady to that of a man. Mr. Davis, who saw a great deal of the animal, never observed this. It may be easily believed that the animal distinguished the fair hand from which it received gifts and attention; but certainly the Giraffes in the Zoological Garden at the Regent's Park exhibit no such preference. They appear to use their tongues generally as organs of examination, and the power of prehension is so great that we have seen the tongue, when extended to the utmost, grasp an ordinary lump of sugar, of which the animals seem very fond, and convey it into the mouth. We have also observed the Giraffes retrovert the tongue for the purpose of cleaning the nostrils, an office which its flexibility enables it to perform in the most perfect manner. The utility of such a power of prehension and extension to an animal whose principal food consists of the leaves and slender twigs of trees is manifest. Mr. Davis says that the tongue can be so tapered as to enter the ring of a very small key.

With regard to the stomach and digestive organs generally, the Giraffe, it is true, wants the receptacle for water which the camel and dromedary possess. There are no water-cells belonging to the rumen as there are in the Camelidæ; and this part of the structure is, as Mr. Owen points out, fashioned according to the horned ruminant

Head of Giraff (Nubian) with the tong elongated.

Head of Giraffe (profile), showing the frontal protuberance and the mane (Nubian).

type. But he also shows that the reticulum is not, as stated by Sir Everard Home, 'destitute of the cellular structure met with in other ruminants,'* but that it has cells, though very shallow ones, as in the rein-deer. Mr. Owen further states that the coils of the colon in the Giraffe are spiral, as they are in the deer and in the antelopes; and that like them it has a simple cæcum, which is 2 feet 2 inches in length. The first Giraffe (female) dissected by Mr. Owen had a double gall-bladder, each bladder of the usual size: this is preserved in spirit in the museum of the College. The other two Giraffes (males) were without a trace of gall-bladder. He believes therefore that absence of the gall-bladder, as in the deer (the antelopes have it), is the rule.

The kidneys in the Giraffes examined by Mr. Owen were not lobulated as in the ox, but simple, as in the deer and antelope.

* Abstracts of 'Phil. Trans.,' vol. ii., p. 389.

Mr. Owen found the male organs to agree with the horned ruminant type; that is, the prostate is divided, not single as in the camel. There is a peculiarity in the termination of the urethra; for it is continued as a membranous canal, one inch and a half beyond the extremity of the glans, adhering to the prepuce. The female organs differ also from those of the camels, and agree with those of the true ruminants, exhibiting processes for the cotyledons in the interior of the cornua.

These are the principal observations made by Mr. Owen in his interesting paper, but he also notices one beautiful provision in the structure of the animal which we must not omit. The nostrils of the Giraffe are provided with cutaneous sphincter muscles, and can be shut at will like the eyes. Mr. Owen supposes that the object of this mechanism is to keep out the sand when the storms of the desert arise.

Every one must be struck with the beautiful large eye of the Giraffe; but he will find upon further examination that it is so prominent and so placed that the animal can see much of what is passing on all sides, even behind it, without turning the head. Thus it is approached with the greatest difficulty; and, if surprised, or run down, it can direct the rapid storm of kicks by which it defends itself in the most accurate manner. We need hardly add that the horny hoofs are divided, and that the two small lateral toes generally seen in the true ruminants are wanting.

Natural History, Systematic Arrangement, &c.

In Deut., c. xiv., where there is an enumeration of meats, clean and unclean, we find (verse 5), among the beasts which the Israelites are permitted to eat, 'the hart, and the roebuck, and the fallow deer, and the wild goat, and the pygarg, and the wild ox, and the *chamois*.' So it stands, or with very slight variation, in the more modern English translations. In the black-letter Bible 'imprinted at London by Robert Barker, printer to the king's most excellent majestie (1615),' we find the same verse thus written: 'The hart, and the roebucke, and the bugle,* and the wilde goate, and the unicorne, and the wild oxe, and the *chamois*.' In the *Physica Sacra*, the verse is thus given in Latin:—'Cervum, Capream, Ibicem, (*a*) Hircocervum, '(*b*) Unicornem, Urum et *Tarandum*;' and a note adds, (*a*) Alii legunt Bubalum aut Bovem Sylvestrem. (*b*) Tragelaphum.' Opposite to this stands the following version of the same: 'Cervum et Capream, Bubalum, Tragelaphum, Pygargum, Orygem, *Camelopardalum*.' These are the Tigurine and Vulgate versions. The original word, it appears, is זֶמֶר, *Zemer*, and Scheuchzer observes that Hieronymus, many interpreters, and many versions render the word by *Camelopardalis*, which is the *Zurapha*, *Zerafet*, and *Zürafet* (plur. *Zerafi* and *Zeraif*) of the Arabians; *Sürnapa*, *Zürnapa*, *Zürnepa*, of the Turks; an interpretation which renders the Arabians and Jews doubtful whether the flesh, which is said to be hard and difficult of digestion, be permitted by the law. Bochart rejects the term *Camelopardalis*, because that animal is not an inhabitant of either Arabia or Palestine, but of Nubia and Æthiopia, and therefore was long unknown to Europeans. Scheuchzer adds that Aristotle says nothing about the Camelopard or Cameleopard—'de eâ nil prorsus habet Aristoteles'—and that the first of the Greeks who described it was Agatharchides, who lived in the time of the sixth Ptolemy (Philometor). This animal, he continues, was not seen at Rome before the time of Cæsar: 'Unde inferre licet, non ignotam fuisse duntaxat Mosis tempore, sed et Alexandri, qui Mose posterior est annis 1200.' Wherefore the commentator has recourse to the Cervine or Caprine genus, and selects the *Rupicapra* (Chamois), observing that 'our two versions' read *Tarandum* (the Reindeer, which, he says, in Meninzk. Lex. has the cognomen of *Sürnapa* and *Giraffa*). In Scheuchzer's plate (cccxxix.) of the clean and unclean animals (*Levit.*, c. xi., v. 2), the Giraffe does not appear, but at pl. cccxli. (*Deut.*, c. xiv., v. 5), he figures a '*Camelopardalis*' and '*Tarandus*'—'Cameel-Pardel' and 'Rennthier,' the former with sharp antelope-like horns, and the latter with a spotted skin and somewhat extraordinary antlers. With the exception of the head and horns, that part of the Camelopard which appears—the hind-quarters are hidden by the other figure—is not bad. Both figures appear to be copies from Jonston, who seems to have copied one of his Camelopards from Gesner. Scheuchzer introduces the body and head of a Camelopard with the same antelope-like horns, but rather more curved, in the back-ground of pl. xxxii. (*Gen.*, c. iii., v. 21.*) The commentator in the 'Pictorial Bible,' where a good cut of the Giraffe is given, says, with reference to the word *chamois*, 'The Arabic version understood that the Giraffe was meant here, which is very likely to have been the case; for the chamois is not met so far to the southward as Egypt and Palestine. The giraffe or cameleopard (*Camelopardalis Giraffa*) is a singular as well as beautiful creature found in the central parts of Africa. The Jews had probably many opportunities of becoming acquainted with the animal while in Egypt, as had also the Seventy, who resided there, and who indicate it in their translation of the Hebrew name.'†

Belzoni notices the Camelopard on the wall of the sekos of the Memnonium, and on the back of the temple of Erments. In Gau's 'Nubien' (pl. 15) is the representation of a relief, for the general character of which we refer to the work itself, and to the interesting account published in the 'Library of Entertaining Knowledge: British Museum—Egyptian Antiquities,' vol. i. In the procession appears, among other animals, a well-executed figure of a Giraffe led by a man dressed in skins. The author of the useful and amusing book last quoted supposes the relief to represent the booty obtained after a victory.

Rosellini, in his great work on Egypt, gives the coloured engraving of a *Pompa*, wherein a Giraffe (*M. C.*, No. xxii., Fig. 2), the spots on which are very close, is depicted as led by two men, who hold cords tied to the fore-legs below what is called, in common parlance, the knee. A green monkey with a red face, &c., and a long tail, is climbing up the Giraffe's neck. The subligacula of the leaders, who appear to be Nubians (?), are different; those of the one are spotted like a leopard-skin, and this man has a dark blue close cap on his head; those of the other show a sort of reticulated pattern, and he wears a close cap with a light ground and light blue spots. And here it is worthy of note that we find in the enumeration of the rare animals exhibited in the Pompa of Ptolemy Philadelphus at Alexandria, described in so lively a manner by one of the Deipnosophists (Athenæus, lib. v., c. 8, s. 32,) one Camelopard—*καμηλοπάρδαλις μία*.

Whether the *ἱππάρδιος* (Hippardius—Horse-pard) of Aristotle (lib. ii., c. 1) be the Giraffe appears to be doubtful, and the prevailing opinion seems to be that he meant by the word some species of Deer. The passage which mentions the *ἱππέλαφος* (Hippelaphus—Horse-stag or Horse-deer)‡ states that both these animals have cloven feet and the head armed with horns, but that the female of the Hippelaphus has no horns; thereby intimating that the female of the Hippardius had. This however would be equally applicable to the rein-deer.

The celebrated Prænestine pavement, said to have been made by the direction of Sylla, who had held the office of quæstor in Numidia, represents the Giraffe both grazing and browzing, and it seems to be a good opinion that the artists employed to work in mosaic even in Italy and Spain were Egyptian Greeks. Still the animal itself does not appear to have been seen in Italy before the time of Julius Cæsar, who exhibited it among other animals in the Circensian games.§

In his description Pliny appears to have taken the darker parts of the skin of the animal as forming the ground colour, and relieved by the lighter tint. This is probably the same animal as that mentioned by Varro, who alludes to a *Camelopardalis*, as having been lately brought from Alexandria, in figure like a camel and spotted like a panther. The Giraffe afterwards became a not unfrequent and conspicuous part of the Roman shows. Thus the third Gordian had ten at one time. We trace the animal in the

* See the note to Bison, vol. iv, p. 462

* 'And unto Adam also and to his wife did the Lord God make coats of skins and clothed them.'

† It should be remembered however that the law above alluded to was given to the Israelites after their departure from Egypt, and when they were in Palestine, where they were not likely to see the animal, much less eat it.

‡ Mr. Ogilby says (*Zool. Proc.* 1836) that Tragelaphus Hippelaphus (Antilope Picta of authors), the Nylghau (Antelope, vol. ii. p. 75) or Neel-ghae, and not the Saumer Deer of India, is the animal described by Aristotle under the name of Hippelaphus.

§ 'Nabin (Pliny, lib viii., c. 18) Æthiopes vocant, collo similem equo, pedibus et cruribus bovi, camelo capite, albis maculis rutilum colorem distinguentibus, unde appellata Camelopardalis, dictatoris Cæsaris Circensibus ludis primum visa Romæ. Ex eo subinde cernitur, aspectu magis quam feritate conspicua: quare etiam ovis feræ nomen invenit.'

writings of Artemidorus, Strabo, Oppian, Heliodorus, and others, till the great blank of literature intervenes.

After the revival of letters, we find in Belon a good description upon the whole, and a very tolerable figure. In the small 4to. intituled 'Portraits d'Oyseaux, Animaux, Serpens, Arbres, Hommes et Femmes d'Arabie et Eg observez par P. Belon du Mans, le tout enrichy de (trains, pour plus facile cognoissance des Oyseaux, et autres Portraits' (1557), the figure is given with only the following notice and quatrain above and below it:—'Portrait de la Giraffe, nommée en Latin, Camelopardalis: les Arabes l'appellent Zurnapa.' The quatrain is

> 'Belles de corps les Giraffes, et doulces,
> Ont en maintien du Chameau la maniere.
> Leurs pieds sont haults devant et bas derriere;
> Poil blanc et roux; cornes courtes et mousses.'

Gillius states that he saw three at Cairo, and gives a description of the animal. Prosper Alpinus relates that he saw a *Camelopardalis*, 'quem Arabes *Zurnap*, et nostri Giraffam appellant,' and likens it to a very elegant small horse.

Gesner, who, among other synonyms, enumerates *Giraffa* (alias *Gyrapha, Girapha*) as the name of the *Camelopardalis*, or *Camelopardus*, or *Camelus Indica*, gives also *Zirafa*, as well as *Nabis* (Æthiopian), *Girnaffa* (Persian), and *Serapha* (Arabian). His figure, which, he says, is taken from an Italian printed book, by an anonymous author, is evidently made up principally from the descriptions of the antients. It has antelope-like subrecurved sharp horns, and a short sharp-pointed tail with something of an upward curve, in which may be traced the 'caudam Dorcalidis, id est Capreoli,' as the text has it, attributed to the animal by Oppian. In the *Additiones* (Icones, &c.) is presented a much better figure, as far as the horns are concerned, but with a neck, and of a height, generally, out of all proportion. The drawing is said to have been diligently taken at Constantinople, where the animal had been sent as a present to the emperor of the Turks, and transmitted to friend in Germany, A.D. 1559. The figure is without spots.

Aldrovandus gives a figure of the animal with its elongated tongue protruded and browzing upon a tree, which, awkward though it be, would be not very far wrong, were it not for the flowing mane and little sharp horns with a curve forwards.

Jonston gives no less than five figures, three with and two without spots, some with and some without manes, under the names of *Camelopardus*, *Camelopardalis*, *Gierafra*, and *Cameli Indici*, but all with sharp horns of various degrees of curvature, besides two long-necked hornless spotted quadrupeds, one designated as *Camelus Indicus versicolor*, the other as *alius Camelus*.

It is not to be wondered at that some of the figures and descriptions given by such writers as the author last quoted cast a doubt upon the very existence of the animal, and it may not be uninteresting, before we proceed to the later writers on the natural history of this extraordinary animal, to note some of the other evidences preserved in old or uncommon books. In the 'Historia del Grand Tamerlane,' (Madrid, 1782), 'The ambassadors sent by the king of Castile, Henry III. (1403—2nd embassy) to the great Tamerlane, arrived at a town called Hoy, now Khoy, on the confines of Armenia, where the Persian empire commences. At that town they fell in with an ambassador whom the sultan of Babylon had sent to Tamerlane. He had with him as many as twenty horsemen and fifteen camels, laden with presents which the sultan sent to Tamerlane. Besides these, there were six ostriches, and an animal called *jornufa* (giraffe), which animal was formed in the following manner:—In body it was of the size of a horse, with the neck very long, and the fore-legs much taller than the hinder ones; the hoof was cloven like that of the ox. From the hoof of the fore-leg to the top of the shoulder it was sixteen hands (palmos); and from the shoulders to the head sixteen hands more; and when it raised its neck it lifted its head so high as to be a wonder to all. The neck was thin like that of the stag; and so great was the disproportion of the length of the hinder legs to that of the fore-legs, that one who was not acquainted with it would think it was sitting, although it was standing. It had the haunches slanting like the buffalo, and a white belly. The skin was of a golden hue and marked with large round white spots. In the lower part of the face it resembled the deer; on the forehead it had a high and pointed prominence; very large and round eyes; and the ears like those of a horse; near the ears two small round horns, the greater part covered with hair, resembling the horns of deer on their first appearance. Such was the length of the neck, and the animal raised its head so high when he chose, that he could eat with facility from the top of a lofty wall; and from the top of a high tree it could reach to eat the leaves, of which it devoured great quantities. So that altogether it was a marvellous sight to one who had never seen such an animal before.'*

In the 'Principal Occurrents in John Leo (Leo Africanus) his Ninth Booke of the Historie of Africa,' (Purchas, lib. vi., c. 1 sec. 9,) we find among the animals of Ethiopia 'The giraffa, so savage and wild, that it is a very rare matter to see any of them; for they hide themselves among the deserts and woods where no other beasts use to come; and so soon as one of them espieth a man, it flieth forthwith, though not very swiftly. It is headed like a camell, eared like an oxe, and footed like a † ; neither are any taken by hunters but when they are very young.' In the index of the same book we find 'Camelopardalis, a huge wilde beast;' and a reference to page 1183, where we find (Purchas, lib. vii. c. 8, s. 2) in the same paragraph, where mention is made of the Abassine soil (Abassia, from Fernandez), this sentence:—'Hares, goats, harts, bores, elephants, camels, buffals, lions, panthers, tigres, rhinocerotes, and other creatures, are there seene, and one so huge that a man sitting on horsebacke may passe uprighte under his belly; his shape is like a camell, but his nature divers, feeding on leaves which he reacheth from the tops of trees with his necke stretched forth.' In the margin is printed, 'This seemeth to be the Camelopardalis;' and indeed the description will do very well for it, with the exception of the horse and his rider passing 'upright under his belly.'

Again, in the fifth volume, 'The sixt booke, chap. i., of Africa, and the creatures therein,' and s. 2, 'Of the beasts, wild and tame,' is mentioned 'The *Giraffa*, or *Camelopardalis*, a beast not often seene, yet very tame, and of a strange composition, mixed of a libard, hart, buffe, and camell, and by reason of his long legs before, and shorter behinde, not able to graze without difficultie, but with his high head, which he can stretch forth halfe a pike's length in height, feeds on the leaves and boughs of trees.'

In a note is added, 'P. Bellon, lib. ii., c. 49, doth largely describe him. (See his description in Moreson and Sandys. Also Master Sanderson saw one at Cairo, and hath described him in his 'Voyage,' which I have printed.' (Tom. i. lib. 9.) Upon turning to the passage (lib. ix., c. 16, s. 2) it appears that Sanderson saw the animal at Constantinople. 'The admirablest and fairest beast that ever I saw was a Jarraff, as tame as a domesticall deere, and of a reddish deere colour, white brested, and cloven-footed; he was of a very great height, his fore legges longer than the hinder, a very long necke, and headed like a camell, except two stumpes of horne on his head. This fairest animall was sent out of Ethiopia to this Great Turke's father for a present; two Turkes, the keepers of him, would make him kneele, but not before any Christian for any money. An elephant that stood where this faire beast was, the keepers would make to stand with all his four legges, his feet close together upon a round stone, and alike to us to bend his fore legges.'‡

In the 'Museum Tradescantianum' (1656), at the end of the second section, 'Four-footed beasts, with some hides, hornes, hoofes,' we find 'divers horns answering to those by authors, attributed to the ibex, gazella, hippelaphus, tragelaphus, cervus palmatus, camelopardalis, &c.'

In Ludolf's 'Æthiopia,' of which there is a curious translation 'made English by J. P. Gent' (1682), the following paragraph appears in the chapter 'of four-footed beasts.' 'The next is the *Camelo-pardalis*, or Panther-camel, which is not' (as big) 'and bulkie as the elephant, but far exceeds him in tallness. For this beast is so very

* See the 'Library of Entertaining Knowledge: Menageries, vol. i. p. 338, small 8vo., London.

† Here there is a word wanting in the original.

‡ c. xvi.

'By the permission of Almightie God,

'Sundrie the personall voyages performed by John Sanderson, of London, merchant, begun in October, 1584, ended in October, 1602, with an historicall description of Constantinople.' The second voyage to Constantinople appears to have commenced in 1591, and Sanderson arrived there on Palm-Sunday, 'where,' says he, 'then I remained sixe or seven yeeres, in which time I had the view of many animals.' After enumerating some, he commences the paragraph which we have above given.

high that a man of a just statue (stature) reaches but up to his knees, so that it seems very credible what is reported, that a man on horseback, sitting upright on his saddle, may ride under his belly. He derives his name from hence, that he has a long head and a long neck like a camel, but a skin spotted all over like a panther. The Romans, when they first beheld this beast, called it a wild sheep, tho being more remarkable for its aspect then (than) its wildness or fierceness, as we read in Pliny. By the Abissines, by reason of the smallness of his tayl, he is called Jeratakacin, that is *Slender Tayl*; by the Italians Giraffa, from the Arabian word *Zucaffa* (Zuraffa?).'

Hasselquist, who travelled in the years 1749-50-51-52, mentions, in his 'Voyages and Travels,' the *Cervus Camelopardalis.* The camel-deer, Bellon., Camelopardalis Giraffa, Alpin., Ægypt, Zurnap, Arab. 'The colour of the whole body, head, and legs of this animal is variegated,' says the traveller, 'with dark brown spots; the spots are as large as the palm of a man's hand, of an irregular figure, and in the living animal are of various shades. This deer is of the bigness of a small camel; the whole length from the upper lip to the tail is twenty-four spans. It is met with in the shady and thick woods of Senaar and Æthiopia. N.B. This is a most elegant and docile animal; it has been seen by very few natural historians, and indeed scarcely by any except Bellonius; but none have given a perfect description or good figure of it. I have only seen the skin of the animal, and have not yet had an opportunity of beholding it alive.' In the 'Act Upsal.' the same zoologist gives a very minute description of the animal.

Brisson gave it a generic station, under the name of Giraffa, in the first section of his fifth order, consisting of those quadrupeds which have no incisor teeth in the upper jaw, but eight in the lower, and the hoof divided. This first section contains those genera which have simple horns; and, besides the Giraffe, comprises the goats, the sheep, and the oxen.

Our countryman John Ray placed the Giraffe under his *Cervinum genus*, the fourth of his ruminants, with the deer, as the title implies.

Linnæus, in the last edition of his 'Systema Naturæ,' (1766), gives the Giraffe as the first species of his genus *Cervus*, or *Cervus Camelopardalis*, and describes it as being a cervus with very simple horns, and the fore-legs, or feet, longest. 'C. cornibus simplicissimis, pedibus anticis longissimis.' The 'habitat' he gives as Æthiopia and Senaar, and adds, that the animal even then was obscure, and that it is sprinkled with white spots like fawns: 'Animal etiamnunc obscurum, adspersum maculis albis, ut cervi juniores.' He alludes to its grazing with divaricated legs, but says that its principal food consists of the leaves of trees.

A drawing, which appears to have been a mere rude sketch, nothing worth, together with a notice of the Giraffe, was brought under the observation of the Académie des Sciences (1764). This drawing and notice related to one of these animals which had been found during a journey made in 1762, as far as two hundred leagues northward of the Cape of Good Hope. Buffon notices this as extending the geographical distribution of the Giraffe, which had been confined to Æthiopia by Thevenot and the majority of writers; but this is the principal contribution to the history of the animal in the Count's article, which is indeed learned and eloquent, but erroneous in many points, and unnecessarily severe on Hasselquist for the dryness and imperfection of his description. Buffon gives the description of the Swedish naturalist in a note, and though there may be some obscurity in the part relating to the horns when read by one who had never seen the animal—and of this Buffon particularly complains—that very part shows the accuracy of Hasselquist. For instance, Hasselquist, after describing the hairs round the edge of the top of the horns, says, 'Apex cornuum in medio horum pilorum obtusus, nudus' (the apex of the horns in the midst of these hairs is obtuse and naked), thus conveying in a few words the real condition of that part of the structure, and showing the acuteness of his observation. But Buffon had no very great love for Linnæus or his pupils; and Sparrman, in his 'Voyage to the Cape,' attacks the French zoologist in no measured terms, exposing with a rough hand his blunders, and appearing resolved to appease the manes of the meritorious Hasselquist for the insult of the count. Buffon's figure is bad, particularly about the horns, and the mane is too long.

The description of M. Allamand, in his supplement to Buffon's account, taken from the specimen sent by M. Tulbagh, governor of the Cape of Good Hope, and preserved at Leyden, well supplies the defects of Buffon, and he gives accurate measurements. We would particularly call attention to the following observations of M. Allamand:—'Although the horns are solid like those of a deer, I doubt whether they are shed like them: they seem to be an excrescence of the os frontis, like the bone which serves for the core of the hollow horns of oxen and of goats, and it is scarcely possible that they can be detached. If my doubt is well founded the Giraffe will be a peculiar genus (un genre particulier) differing from all those under which are comprehended the animals who shed their horns and those whose horns are hollow but permanent.' Again, he says, 'the adult Giraffes have in the middle of their forehead a tubercle which seems to be the commencement of a third horn: this tubercle does not appear upon the head of our specimen, which probably was as yet too young to show it.' M. Allamand also remarks that in this young specimen the height of the posterior legs equals that of the anterior, and that the mane is three inches in length.

In *Phil. Trans.* (vol. lx., p. 27) is the following 'Letter on a Camelopardalis found about the Cape of Good Hope, from Captain Carteret to Matthew Maty, M.D., sec. R.S.,' dated on board of the Swallow, Deptford, 20th April, 1769—read January 25, 1770.—

'Sir,—Inclosed I have sent you the drawing of a Camelopardalis (Tab. 1), as it was taken off, from life, of one near the Cape of Good Hope. I shall not attempt here to give you any particular description of this scarce and curious animal, as it is much better known to you than it can be to me; but from its scarcity, as I believe none have been seen in Europe since Julius Cæsar's time (when I think there were two of them at Rome), I imagine its drawing and a more certain knowledge of its reality will not be disagreeable to you. As the existence of this fine animal has been doubted by many, if you think it may afford any pleasure to the curious, you will make what use of it you please.

'The present governor of the Cape of Good Hope has sent out parties of men on inland discoveries, some of which have been absent from eighteen months to two years, in which traverse they have discovered many curiosities, which it is to be hoped they will in convenient time communicate to the world. One of these parties crossed many mountains and plains, in one of which they found two of these creatures, but they only caught the young one, of which the inclosed is the drawing, as it was taken off by them; they endeavoured to bring it alive to the Cape town, but unfortunately it died. They took off his skin, which they brought as a confirmation of the truth, and it has been sent to Holland. These particulars, as well as the drawing, I got from Mr. Barrawke, first secretary to the Dutch Company at that place, in the presence of the governor. I am, sir, your most humble most obedient servant,

Ph. Carteret.'

To this is appended the following note:—

'The animal described in this letter is now in the cabinet of Natural History at Leyden, where I have seen it this year. M. Maty.'

Then comes the figure, and opposite to it, p. 29—

'Dimensions of a male Camelopardalis, killed in a journey made in the year 1761, through the country of a tribe of Hottentots, called the Mamacquas:—

	Ft.	In.
'Length of the head	1	8
Height of the fore-leg, from the lower to the higher part	10	0
From the upper part of the fore-leg to the top of the head	7	0
From the upper part of the fore-leg to the upper part of the hind-leg	5	6
From upper part of the hind-leg to the tail	1	6
Height of the hind-leg from the upper to the lower part	8	5'

Pennant, in the first edition (1771) of his 'Synopsis of Quadrupeds,' shows to what extent the doubts of the animal's existence had been carried; for, after adverting to its locality, 'the forests of Æthiopia and other interior parts of Africa,' and its habits, he proceeds—'I saw the skin of a young one at Leyden well stuffed and preserved; otherwise

I might possibly have entertained doubts in respect to the existence of so extraordinary a quadruped. Belon's figure is very good.' The specimen here alluded to was most probably that mentioned by M. Allamand and in Captain Carteret's letter.

The travels of Dr. Sparrman occupied a period from the year 1772 to 1776. He gives Allamand's description, and adds the following: 'This animal, when it goes fast, does not limp, as some have imagined, but sometimes paces and sometimes gallops. Every time it lifts up its fore-feet it throws its neck back, which on other occasions it holds erect; notwithstanding this, it is by no means slow when pursued, as M. de Buffon supposes it to be, but, on the contrary, it requires a fleet horse to hunt it. In eating the grass from off the ground it sometimes bends one of its knees, as horses do; and, in plucking leaves and small branches from high trees it brings its fore-feet about a foot and a half nearer than usual to the hind feet. A camelopardalis which Major Gordon wounded in the leg, so that it could not raise itself from the ground, nevertheless did not show the least signs of anger or resentment; but, when its throat was cut, spurned against the ground with a force far beyond that of any other animal. The viscera resembled those of gazels, but this animal had no porus ceriferus. The flesh of the young ones is very good eating, but sometimes has a strong flavour of a certain shrub, which is supposed to be a species of *mimosa*. The Hottentots are particularly fond of the marrow, and chiefly for the sake of this hunt the beast, and kill it with their poisoned arrows. Of the skin they make vessels, in which they keep water and other liquors.'

Le Vaillant did not meet with the Giraffe till his second journey into the interior of Africa from the Cape during the years 1783-84-85. But at the end of the 2nd volume of his first journey, which commenced in 1780, he gives figures of a male and female Giraffe, and a compendium of his observations, remarking that it is a kind of anticipation which is owing in some measure to solicitations which he ought to consider as commands. As Le Vaillant appears to be the first well-informed zoologist of modern times who saw the animal in a state of nature, and as he hunted it and brought it down with his own fusil, his account is worthy of particular attention.

'If,' says Le Vaillant, 'among the known quadrupeds precedency be allowed to height, the giraffe without doubt must hold the first rank. A male which I have in my collection, and of which a figure is given in the 8th plate, measured, after I killed it, 16 feet 4 inches, from the hoof to the extremity of its horns. I use this expression in order to be understood; for the giraffe has no real horns, but between its ears, at the upper extremity of the head, arise, in a perpendicular and parallel direction, two excrescences from the cranium, which without any joint stretch to the height of eight or nine inches, terminating in a convex knob, and are surrounded by a row of strong straight hair, which overtops them by several lines. The female is generally lower than the male. That represented in the following plate was only 13 feet 6 inches in height; and her incisive teeth, which were almost all worn away, incontestably proved that she had attained to her full growth. In consequence of the number of these animals which I killed and had an opportunity of seeing, I may establish as a certain rule that the males are generally 15 or 16 feet in height, and the females from 13 to 14 feet. Whoever should judge of the thickness of these animals from the above dimensions would be greatly deceived. The eye indeed that is accustomed to the long, full figures of Europe, finds no proportion between a height of 16 feet and a length of seven, taken from the tail to the breast. Another deformity, if it may be called so, makes us contrast the parts before with those behind. The former have a considerable thickness towards the shoulders, but the latter are so thin and meagre that they do not seem formed the one for the other. Naturalists and travellers who speak of the giraffe all agree in making the hind legs only half the length of those before; but did those who assert so really see the animal, or, if they saw it, did they consider it attentively? An Italian author, who certainly never saw it, caused a figure of it to be engraved at Venice, in a work, entitled 'Descrizioni degli Animali,' 1771. This figure is formed exactly from the descriptions which had then been published of the animal; but this exactness renders it so ridiculous, that we must consider it, on the part of the Italian author, as a severe criticism on all the accounts which had appeared, and which have been so often repeated.' Le Vaillant then goes on to remark that of all the old authors who have treated of this animal Gillius is the most accurate, who expressly says that the giraffe has its four legs of the same length; but that the fore-thighs are so long in comparison of those behind that the back of the animal appears inclined like the roof of a house. 'If,' says Le Vaillant, 'by the fore-thighs Gillius means the omoplate, or shoulder-blade, his assertion is just, and I perfectly agree with him.' In a note it is added, that among the moderns the most exact engraving is without doubt that which was executed under the inspection of Dr. Allaman, from drawings furnished by Colonel Gordon. After observing that the account of Heliodorus is far from being correct, Le Vaillant continues thus:—'The horns, forming part of the cranium, as I have already said, can never fall off. They are not solid like those of the stag, nor composed of any substance analogous to those of the ox; much less do they consist of hair united, as Buffon supposes. They are simply of a bony calcareous substance, divided by a multitude of small pores like all bones, and are covered throughout their whole length with short coarse hair, which has no resemblance to the soft down that covers the young horns of roebucks or stags.' The French traveller then notices the defective figures of Buffon and Vosmaer, observing that the defects disgrace and render of no utility to science such false representations, which people very improperly confide in on account of the reputation of the authors who publish them. He states that the giraffes, both male and female, are spotted in the same manner; and that, without paying attention to the inequality of size, they may easily be distinguished from each other, even at a distance. The male, on a greyish-white ground, has large spots of a dark-brown colour, almost approaching to black; and the female, on a like ground, has spots of a tawny colour, which renders them less striking. The young males are at first of the colour of their mother, but in proportion as they advance in age and size they become browner.

We must here interrupt Le Vaillant's interesting account to remark that, as yet, no difference of any consequence can be seen in the colour of the spots of the male and female giraffes in the gardens of the Zoological Society of London; they are tawny in both.

To return to Le Vaillant: he says that these quadrupeds feed upon the leaves of trees, and particularly on those of a mimosa peculiar to the canton which they inhabit. Meadow-grass also forms part of their aliment; but they are not under the necessity of kneeling down to browze or to drink, as some have improperly believed. They often lie down to ruminate or to sleep, which causes a considerable callosity on the sternum, and makes their knees to be covered with a hard skin. 'Had nature,' says our author in conclusion, 'endowed the giraffe with an irascible disposition, it certainly would have had cause to complain; for the means with which it is provided either for attack or defence are very trifling. It is indeed a peaceful and timid animal; it shuns danger, and flies from it, trotting along very fast: a good horse can with difficulty overtake it. It is said that it has not strength to defend itself; but I know, beyond a doubt, that by its kicking it often tires out, discourages, and even beats off the lion. Except upon one occasion I never saw it make use of its horns: they may be considered of no utility, were it possible to doubt the wisdom and precautions employed by nature, whose motives we are not always able to comprehend.'

Gmelin, in his 13th edition of the 'Systema Naturæ' (1789), elevates the giraffe to a genus under the name of *Camelopardalis*, with the following generic character:—Horns very simple, covered with skin (simplicissima pelle tecta), terminated by a fasciculus of black hairs. Lower incisor teeth (dentes primores inferiores) eight, spatulate, the last deeply bilobated externally. He gives one species, *Camelopardalis Giraffa*, and says that it inhabits Sennaar, between Upper Egypt and Ethiopia, where it has been now seen; that it is rare in Abyssinia, and most rare in more Southern Africa; that its haunts are leafy woods and that it is wild, timid, very swift (celerrima), and elegant; that it reposes prone like a camel; that it feeds on grass by divaricating the fore-legs, but that its principal food consists of the leaves of trees.

In the third edition of Pennant (1793), several additions are made to the description of the giraffe, but he does not notice Le Vaillant, though the first part of the travels of

the latter, containing the account which we have already given, was published before the issue of the edition and before it left Pennant's hands; for the preface with his signature is dated 'Downing, December, 1792.' He alludes to the measurement in the *Journal Historique*, and, quoting Paterson, describes the horns as one foot and half an inch long, ending abrupt, and with a tuft of hair issuing from the summit, adding that they are not deciduous.

'The height of that killed by Mr. Paterson,' he continues, 'was only 15 feet. The head is of an uniform reddish-brown; the neck, back, and sides, outsides of the shoulders and thighs, varied with large tessellated, dull rust-coloured marks of a square form, with white septaria, or narrow divisions; on the sides the marks are less regular; the belly and legs whitish, faintly spotted; the part of the tail next to the body is covered with short smooth hairs, and the trunk is very slender; towards the end the hairs are very long, black, and coarse, and forming a great tuft hanging far beyond the tip of the trunk; the hoofs are cloven, nine inches broad, and black. This animal wants the spurious hoofs. The female has four teats. Mr. Paterson saw six of these animals together; possibly they might have been the male and female with their four young.' Pennant then goes on to say that the animal inhabits the forests of Ethiopia, and other interior parts of Africa, almost as high as Senegal; but is not found in Guinea or any of the western parts, and, he believes, not farther south than about lat. 28° 10′ (*Journal Historique*), among the Nemaques (Namaquas) on the northern side of the Orange River, and that it is very timid but not swift. He says, after alluding to the necessity for the animal to divaricate its legs very widely if it would graze, that it therefore lives by browzing the leaves of trees, especially those of the *mimosæ* and a tree called the wild apricot. 'When it would leap,' he adds, 'it lifts up its fore-legs and then its hind, like a horse whose fore legs are tied. It runs very badly and awkwardly, but continues its course very long before it stops. It is very difficult to distinguish this animal at a distance, for when standing they look like a decayed tree, by reason of their form, so are passed by, and by that deception escape.' Immediately after this, Pennant repeats *verbatim* the sentence from the first edition, stating that he had seen the skin of one at Leyden, otherwise he might have entertained doubts, &c. The figure given in this edition is evidently taken from a stuffed specimen, but comes much nearer to the animal than any of those we have hitherto mentioned, except Le Vaillant's. Mr. Paterson who is here mentioned was sent to the Cape as a botanist by Lady Strathmore, and he brought to this country, on his return, the first entire specimen of a giraffe recorded. Lady Strathmore gave it to John Hunter, in whose museum it long was, and the Trustees of the Museum of the Royal College of Surgeons transferred the skin to the British Museum when that of the college was cleared of the stuffed skins to make way for preparations more in unison with its general zootomical character. This skin, now almost entirely hairless, stands at present on the landing-place at the top of the stairs in the British Museum.

The animal, after this, still continued to be noticed in books of Natural History, but nothing worthy of notice occurs to us, though the reader may be referred to the 'Zoography' of Wood, and especially to Shaw's 'Zoology,' for the information there collected.

Cuvier, in the first edition of his 'Règne Animal' (1817), speaks of the Giraffe, Camelopardalis, as having for its characters conical persistent horns in both sexes, covered with a hairy skin, and as being one of the most remarkable animals on account of the length of its neck, the disproportioned length of the fore-legs, the osseous tubercle on the chanfrein, &c., but dismisses it with a very brief notice. He places it between the Deer (*Cervus*) and the Antelopes (*Antilope*).

Major (now Lieut.-Col.) Hamilton Smith, who has devoted so much attention to the Cervine and Antelopine groups, observes that the Giraffe stands isolated among the ruminating animals in family, genus, and even species: its characters, he remarks, offer a mixture of several genera; among which the followers of the quinary system may select whether to class it, with Illiger, among Cameline, or, with other naturalists, amongst Cervine or Antelopine animals. The same zoologist points out its assimilation with the camels by the length of the neck, the callosities on the sternum and knees, and the want of spurious hoofs, an approximation so obvious that it did not escape the notice of the antients; but, he adds, that the pedunculated form of the frontal process, in the shape of horns, recals that character in the Muntjak deer, while the stiff hairs which crown their summits seem to want only the gluten to cement them into true horns and embody it in systematic arrangement with the *Cavicornia*. From a comparison of the characters which Colonel Smith institutes, he thinks that the Giraffe appears most naturally placed immediately after the Muntjaks, and before the family of *Cavicornia*, or those ruminants which are distinguished by the possession of true horns.

M. Lesson, in his 'Manuel' (1827), places the *Camelopardinées* between the *Cervules* (*Cervus Muntjak*, *Cervus moschus* or *moschatus*, and *Cervus subcornutus*) and the *Tubicornes* (Antelopes, &c.).

Cuvier, in his last edition of the 'Règne Animal' (1829), appears to take the same view of the case as Lieutenant-Colonel Smith, for he there places the Giraffe between the Muntjak and the *Ruminants à cornes creuses*, the first genus of which is *Antilope*. The character assigned to the genus in this edition differs somewhat from that given in the former one, for Cuvier, who seems to have been acquainted with Dr. Rüppell's interesting memoir above alluded to, adds that the bony core (noyau osseux) of the horns is articulated in youth upon the os frontis by a suture, and that in the middle of the chanfrein is a tubercle or third horn, larger and much shorter, but equally articulated by a suture. He still keeps the observation as to the disproportioned height of the fore-legs.

Fischer, in his Synopsis, introduces the Giraffe (Camelopardalis) between *Cervus* (*Cervus Guineensis*, Linn., *C. minutus*, Blainv.) and *Antilope* (*A. cervicapra*). He notices the opinion of M. Geoffroy, that the Giraffe of Senaar differs in species from that of the Cape, and he alludes to the following names of the animal:—*Jiratalla Amhar*; *Deba*, Æthiop.; *Naip*, Hottent.; *Impatoo*, Bosjesman.

Mr. Swainson, 'Classification of Quadrupeds' (1835), appeals to the opinion and views of Colonel Smith, as confirming the station assigned to the *Camelopardæ*, in his tabular exposition of the families of Ruminants, viz.:—

Tribe RUMINANTES. The Ruminating Quadrupeds.

1. Sub-typical.	Horns sheathing: form gracile, slender.	Antilopidæ.	Antelopes.
2. *Typical.*	Horns sheathing; form heavy, robust.	Bovidæ.	Oxen.
3. *Aberrant Group.*	Horns solid, deciduous.	Cervidæ.	Stags.
	Horns wanting; fore-legs shorter than the hinder.	Moschidæ.	Musks.
	Horns very short, covered with a skin.	Camelopardæ.	Giraffes

The following is Mr. Swainson's definition of his family *Camelopardæ*. 'Frontal processes (in both sexes) prolonged in the shape of horns, covered with hairy skin, which is continued from the scalp, and terminated by long hard bristles.' '*Camelopardalis* Aut., cutting teeth $\frac{0}{8}$; canine none; grinders $\frac{6}{6}$; head long; upper lip entire; lachrymary sinus wanting; neck enormously long, with a short mane; the anterior parts much elevated; back sloping; legs slender, the hinder ones shortest; tail tufted. 2. Sp. Africa. 1. *Cam. Antiquorum*, Sw., Northern Giraffe. 2. *C. Australis*, Sw., South African Giraffe. The ruminants are united by this genus and *Camelus* to the *Solipedes*.' The family is accordingly placed in this part of the work,* between the *Moschidæ* and the 'tribe' *Solipedes* (single-hoofed quadrupeds), the first genus of which, in Mr. Swainson's arrangement, is *Camelus*. Mr. Swainson adds, that there seems good reason for believing that a third species of Giraffe exists in the interior of Africa.

We must now trace the re-appearance of the living animal in Europe. M. Lesson states that the first were an offering by the Prince of Damascus to the Emperor Frederic II., and described by Albertus Magnus, under the name of *Sereph* and *Anabula*. The author of the 'Menageries' remarks that, till the year 1827, when a Giraffe arrived in England and another in France, the animal had not been seen in Europe since the end of the fifteenth century, when the Soldan of Egypt sent one to Lorenzo de' Medici. This individual was represented in the frescoes at Poggio Acajano, a villa belonging to the grand-duke of Tuscany, between Florence and Prato. It was, the author

* 'The class mammalia, arranged according to its natural affinities.'

adds, very familiar with the inhabitants in the former city, living on the fruits of the country, particularly apples, and stretching up its long neck to the first-floors of the houses to implore a meal. Of the comparatively late arrivals, another was at Venice in 1828, and a fourth was sent to Constantinople, but died there. These animals, according to the same authority, were all presents from the Pasha of Egypt. The Giraffe sent to the French menagerie is still alive: that presented at the same time to George IV. was the shortest and weakest. (The consuls of each nation drew lots for the choice.) She was never in good health and had been roughly treated, and though she had grown eighteen inches up to June, 1829, she sank gradually and died in the autumn of that year.

The Zoological Society of London had entered into a contract for the purchase of Giraffes, and in 1836 four of these animals (three males and one female) were safely brought from the south-west of Kordofan, where they were captured, to the gardens of the Society at the Regent's Park. One of these (a male) was never so strong as the rest, and having fallen from weakness, a few months after its arrival, injured its head so severely that it died. The other three are still (February, 1838) in excellent health and condition. Mr. Cross, the enterprising proprietor of the Surrey Zoological Gardens, soon after imported three (two males and one female), also from Northern Africa, but we regret to write that they are all dead.

We now return to the systematic arrangement. In December, 1836, Mr. Ogilby divided the Ruminantia into the following families:—1. *Camelidæ*. 2. *Cervidæ*. 3. *Moschidæ*. 4. *Capridæ*. 5. *Bovidæ*. The genus *Camelopardalis* is placed by this zoologist, to whom we are indebted for much and valuable information concerning the Ruminants, as the first of the *Cervidæ*, with the following characters:— *Horns*, in both sexes, persistent (perennia), simple, covered with skin. *Rhinaria*, none. *Lachrymal sinuses*, none. *Interdigital fossæ*, small. *Inguinal folliculi*, none. *Teats*, four:—and two species are recorded under the names of *C. Æthiopicus* and *C. Capensis*. The other genera admitted by Mr. Ogilby into the family *Cervidæ* are *Tarandus*, *Alces*, *Cervus*, *Caprea*, and *Prox*.

The main result of Mr. Owen's observations (1838) is to agree with Cuvier in placing Camelopardalis between *Cervus* and *Antilope*, and, he thinks, somewhat nearer the deer. He finds that the *Organs of Relation* are those chiefly modified in correspondence with the peculiar geographical position and habits of the Giraffe, the *Organs of Nutrition* differing but little from those of other horned Ruminants.

We have now endeavoured to give a sketch of the organization and history of this most interesting genus. We would particularly refer the reader, in addition to the notices given, to the interesting details of Le Vaillant and Mr. Burchell, M. Geoffroy's memoir in the eleventh vol. of the 'Ann. des Sc. Nat.,' the account of the journey of the French Giraffe above alluded to in the 'Mém. du Mus.,' and the lively narrative of M. Thibaut, relating to the capture of the Giraffes belonging to the Zoological Society of London. (*Zool. Proc.*, 1836.) We are indebted to Mr. Miller, the superintendent, for the following measurements of these fine healthy animals, which reflect so much credit on the Society, and on those under whose peculiar care they are placed (29th January, 1838):—

	Height as far as reach. Feet.	Inches.	Wither. Feet.	Inches.	Rump. Feet.	Inches.
Guib Allah (male)	13	8	7	11	6	11
Selim (male)	13	0	7	5¼	6	7
Zaida (female)	12	11	7	4	6	7

When they arrived at the Gardens on the 24th of May, 1836, Guib Allah could reach only to eleven feet six inches, so that he has grown since that time two feet two inches. The others have grown in proportion. The length of the mane in one of the males and in the female is two inches and three quarters, and in the other male two inches and a half.

They are fed principally on the best hay, placed in high racks; they like a carrot, and are very fond of onions; lump sugar is also a favourite treat to them.

The coronet of upright hairs which surrounds the bare knob is seen best in the female; for in the two males the hairs are very much rubbed off, in consequence of their butting against each other; they seem to do this more in friendly contention than in anger, though one of them has a large space on the lower part of the neck bared of hair by this butting. The coronet of hairs is not very stiff, and the hairs are matted together at the roots. The keepers never saw them kick at each other; sometimes they will strike out with their fore-feet. In moving they lift two legs on the same side, though not exactly simultaneously.

The erroneous statement that the fore-legs are longer than the hind-legs has been repeated so frequently and so lately by authorities which deservedly have weight, that it becomes necessary to give the result of examination of the skeleton. In reality the hind legs, taking the limbs only from their setting on, are longer than the fore-legs by about one inch. A measurement taken from the head of the humerus to the end of the ungueal phalanges in the fore-foot gives an inch less in length than a measurement taken from the head of the femur to the end of the ungueal phalanges in the hind foot.

Camelopardalis Giraffa.

Neither Mr. Swainson nor Mr. Ogilby gives any specific characters for the two species named by them. If, as Mr. Owen's observations tend to show, there is no third horn in the forehead of the northern male Giraffes, we do not exactly see on what the specific character is to rest. The dark colour of the adult male of Southern Africa, if it should prove to differ from that of the northern male, would not, it is submitted, sanction more than variety. The specimens presented by Mr. Burchell to the British Museum came from Kosi Fountain, and the difference between the dark spots of the male and the tawny spots of the female is strongly marked. The specimen from Central Africa presented by Colonel Denham is very young, and the spots are bright yellowish tawny. Mr. Steedman, in his 'Wanderings and Adventures in the Interior of Southern Africa,' (1835), says that the Giraffes are found on the open plains several days' journey to the north of Litakou, in small troops of six or ten individuals, and that they feed principally upon the various dwarf species of Acacia* which

* Sir Everard Home states that the favourite species is Acacia Xariffiana, named from Zariffa, the Giraffe. Le Vaillant says that 'the sort of Mimosa' on which it feeds is called *Kanaap* by the natives, and *Kameldoorn* by the colonists.

grow abundantly in the arid deserts. The writer adds, that though formerly found within the boundaries of the Cape of Good Hope, they have not for many years past been known to pass the Gareep, or Orange River, which separates it from the Griqua and Coranna country; and he notices their moving the fore and hind feet of the same side, and then the opposite pair alternately, exhibiting the pace which is usually called an amble in horses.

The learned reader will observe that we have omitted several authors who have noticed the Giraffe. Klein, Schreber, Erxleben, Vosmaer, Zimmerman, Lichtenstein, and others, for instance, among the zoologists, and Marco Polo, who places the *Graffe*, or *Giraffe*, in the isle of Zanzobar.

GIRALDUS CAMBRENSIS. [Barri.]

GIRARDON, FRANÇOIS, a distinguished French sculptor, was born at Troyes in 1628. His father, Nicolas Girardon, a bronze-founder, designed him for the law, and he was accordingly placed with a procureur, but, quickly disgusted with that profession, he devoted himself entirely to sculpture. At first he had no other assistance than the hints he derived from studying some works executed by Primaticcio's pupils, till happening to attract the notice of the Chancellor Séguier, he was enabled to obtain proper instruction, and afterwards to visit Italy, his patron having procured for him a travelling pension from Louis XIV. On his return he was much employed by that monarch; yet instead of trusting to his own merit and abilities, he constantly paid his court to the painter Le Brun (who stood high in the royal favour) with more servility than became a man of talents. Through that artist's influence he obtained some distinction in the Academy of Painting, where he rose through various grades of office; but it was at the price of complying too far with the taste of Le Brun and his followers. Neither was this policy without its other disadvantages; for when Louvois succeeded Colbert as minister, he took Mansard into favour, and turned his back upon Le Brun and his adherents. Nevertheless, after the death of Le Brun, Girardon was appointed curator of the sculpture at the royal palaces, in which office he is reported to have disgusted Puget, who shortly after retired to Marseille; though it is not clear whether this may not be attributed quite as much to the pride of the latter as to the jealousy and ill-will of the former. Girardon married Catherine Duchemin, a lady who obtained some reputation as a flower-painter. He died September 1, 1715, on the same day as Louis XIV.

As an artist, his works had, if less expression, generally more elegance than those of his rival Puget. With some allowance for the false taste of the time, there is in them much beauty of composition, together with correctness of forms and proportions. Their execution however is very unequal, which is to be attributed to his leaving many of his designs to be wrought either entirely or nearly so by his pupils and assistants. Among those on which he bestowed the most pains, and which are considered his chefs-d'œuvre, are the Mausoleum of Cardinal Richelieu, the group of the Rape of Proserpine, and the four principal figures in the Bath of Apollo, at Versailles, and the bronze equestrian statue of Louis XIV., formerly in the Place Vendôme; on the subject of which last Boffrand published a work entitled 'Description de ce qui a été pratiqué pour fondre en bronze d'un seul jet la figure équestre de Louis XIV.' fol. 1743.

GIRDLE, a band of leather, or some other substance, to gird up the loins: from the Anglo-Saxon *gyrdel* or *gyrdl*, and that from *gyrdan*, to encircle or bind around. Girdle-stead is an old English word for the waist, or place of the girdle.

There are many passages in Scripture, as well as among the Greek and Roman writers, illustrative of the girdle. It appears to have been rarely worn by the Hebrews except upon a journey. Elijah, we are told, girded up his loins, and ran before Ahab. Girdles of sackcloth too were used among the Hebrews as marks of humiliation and sorrow.

As a military ornament it is noticed in Homer; and so universal was its use among the Greek and Roman warriors, that Pitiscus in his Lexicon says, 'Et *Cingulum* pro ipsa militia usurpatur.' Military girdles were often given as rewards for bravery.

'Zonam solvere virgineam,' to loose the maiden's girdle, in the language of Catullus, was a phrase appropriate to the marriage ceremony. Festus says, 'Cingulum quo nupta cingebatur vir in lecto solvebat.' This girdle was usually of wool.

The term girdle was in antient times very frequently used to express the purse. An epigram in the 'Anthologia' shows that this was the custom among the Greeks: and it is in this sense that we must understand the fragment of Gracchus's speech to the senate, upon his return from Sardinia, quoted in Aulus Gellius, lib. xv., c. 12: 'Itaque Quirites, quum Romam profectus sum, zonas, quas plenas argenti extuli, eas ex provincia inanes retuli.'

In Mark, vi. 8, when our Saviour sent his Apostles out to preach, he commanded them to take no scrip, no bread, no money in their purse: the Anglo-Saxon version reads *ne fesh on hyra gyrdlum*, 'nor money in their girdles.' Hence probably arose the custom, formerly used in England, for bankrupts or other insolvent persons to put off and surrender their girdles in open court.

Various passages in the classic writers might be adduced to show that to go without the girdle was considered disreputable, and bespoke a dissolute person. Aubrey, in one of his manuscripts, says that 'Ungirt, unblessed,' was an English proverb before the civil wars of Charles I.

What has been said of the girdle suggests an inference that the making of girdles must once have been an important trade, though in these times the girdler is chiefly a maker of bridles.

Among the antient companies of London, that of the Girdlers was incorporated as early as August 6, 1448, 27 Henry VI. Their armorial ensigns are 'Per fess, az. and or,' a pale counter-changed, each piece of the first charged with a gridiron of the second. Crest, the demi-effigy of St. Lawrence holding in the right hand a gridiron, and in the left a book. The motto, 'Give thanks to God.' Strype, in his edition of Stow's *Survey*, conjectures, from their arms, that the girdlers were originally a fraternity of St. Lawrence. Their Hall, in Basinghall Street, was built in 1681.

GIRGEH. [Egypt.]

GIRGE'NTI, the chief town of a province of Sicily, is built on the slope of a hill about three miles from the coast, and about one mile from the ruins of old Agrigentum. The town is irregularly built; it is a bishop's see, and has a clerical seminary with a library and cabinet of medals. The population, which is about 15,000 inhabitants, carry on some trade in agricultural produce through the neighbouring harbour, which is frequented only by small vessels. The principal articles of exportation are corn, fruit, and sulphur. In the cathedral of Girgenti is an antient sarcophagus, with a good basso-rilievo. The province of Girgenti is divided into three districts, Girgenti, Sciacca, and Bivona, which reckon altogether 294,000 inhabitants (Neigebaur). The other towns besides Girgenti are, 1. Sciacca, a maritime town with 13,000 inhabitants, whose chief occupation is the fishing and pickling of sardines, which abound on this coast. The country around has many plantations of pistachio nuts. Hot mineral springs, the antient Thermæ Selinuntiæ, are in this neighbourhood. 2. Castronovo, inland, on a mountain, with 8000 inhabitants. 3. Bivona, with 6000, and a royal college. Petroleum is procured in the neighbourhood. 4. Aragona, with an old castle and 6000 inhabitants, is situated in a delightful country interspersed with almond plantations. The mud volcano of Maccaluba is in the neighbourhood. Another object of notice in this district is the Casali dei Greci, consisting of several villages inhabited by an Epirote colony which settled here in 1486, and who still retain their dress and the Greek form of worship, but their clergy acknowledge the supremacy of the pope. (Serristori, *Saggio Statistico*.)

GIRONDE. The name given to the æstuary of the Garonne and the Dordogne. [France; Garonne.]

GIRONDE, a maritime department of France, lying between 44° 10′ and 45° 35′ N. lat., and 17′ E. and 1° 16′ W. long. It is bounded on the N. and N.E. by the department of Charente Inférieure, from which in one part it is separated by the river Gironde; on the E. by the department of Dordogne; on the S.E. by the department of Lot-et-Garonne; on the S. by the department of Landes; and on the W. by the Gulf of Gascogne, or (as we call it) the Bay of Biscay. The form of the department is very irregular, except along the coast, which runs in nearly a direct line N. and S. for 75 miles. The coast is lined with sand-hills, and these are skirted on the inland side by the Etangs of Carcans and Canau, and the Bassin or inlet of Arcachon;

the Etangs communicate with each other and with the Bassin, which is shallow and studded with islets, and opens into the sea. The greatest length of the department from N.N.W. to S.S.E. is 106 miles; its greatest breadth at right-angles to the length, 80 miles. Its area is estimated at 3770 square miles, which is more than half as much again as the average extent of the French departments, and about equal to the conjoint areas of the English counties of Kent, Surrey, and Sussex. The population in 1836 was 555,809, which exceeds the average population of the French departments by more than a third; the relative population is 147 to a square mile, which is below the average of France, and less than half the relative population of the above-named English counties. Bordeaux, the capital, is in 44° 50′ N. lat., 35′ W. long.; 307 miles in a direct line S.S.W. of Paris, or 376 by the road through Chartres, Vendôme, Tours, Poitiers, and Angoulême.

Surface; Hydrography; Communications.—The general character of the surface is level; there are some hills in the eastern part of the department, which may be considered as remote ramifications of the highlands of central France; the country west of the Garonne is a dead flat. The Garonne enters the department on the S.E. side, the Dordogne on the E., and these rivers gradually converge and form the æstuary of the Gironde. The Isle, a feeder of the Dordogne, and its tributary, the Dronne, water the north-eastern part of the department, and there are in the N.E. and E. several small streams which flow immediately or remotely into the Dordogne. The feeders of the Garonne which are in the department are, with the exception of the Dropt, all small; and the country west of that river is ill provided with water except just along the valley of the Garonne, and in the south part of the department where the Leyre flows into the Bassin or bay of Arcachon. The extent of water navigation is thus given in the official returns:—

	Miles.
Garonne and Gironde	110
Feeders of Garonne:—	
Dropt	30
Dordogne	68
Feeder of Dordogne:—	
Isle	57
Feeder of Isle:—	
Dronne	1
	266

There are no canals for navigation.

There are in the department six *Routes Royales* (government roads), having an aggregate length of about 225 miles, of which about 90 miles are in good repair; the rest is either out of repair or unfinished. There are 19 *Routes Départmentales* (roads at the charge of the local government), having an aggregate length of about 370 miles, for the most part in good repair. The bye-roads and paths may be estimated at about 6600 miles. There is one *Route Royale* of the first class, the road from Paris into Spain, which passes by Bordeaux along the valley of the Garonne, and thence by Bazas into the department of Landes. The other *Routes Royales* branch off from this, or lead from Bordeaux to various other places.

Geological Character.—Nearly the whole of the department is occupied by the various strata of the supercretaceous group; the chalk rises to the surface just upon the N.E. boundary of the department. Good building-stone is quarried.

Climate; Soil: Agricultural and other Produce.—The climate is temperate, and, except in the Landes, generally healthy; the sea breezes and the frequent rains temper the heat, which would otherwise be excessive. The Landes, or sandy heaths, of which only a small part has been brought into cultivation, occupy nearly half of the department, extending from the sea to the valley of the Garonne. The sands of the downs along the sea-shore, driven inland by the winds, gradually overspread a considerable tract of country, encroaching yearly from 70 to 80 feet along the whole extent of the coast. In the district of Médoc, N.W. of Bordeaux, many houses had been destroyed; near the canal of Furnes a church has been so completely buried that the steeple alone is visible, and naked boughs rising 8 or 10 feet above the surface are all that can be seen of a forest near the bay of Arcachon, which has been overwhelmed in like manner. The increasing devastation has however been checked by carrying into effect the suggestion of M. Bremontier, an engineer, of fixing the sand by covering it with a vegetation suited to the soil. Whether from the evils of excessive poverty, or from any noxious property in the air, the average duration of human life among the inhabitants of the Landes is barely two-thirds of its duration in the other parts of France. Between the Garonne and the Dordogne, and in that part of the department which is to the north of the latter river, the soil is chiefly calcareous; it is mingled with considerable districts of sandy and some of gravelly soil, and with rich loamy tracts. The surface of the department is calculated at 2,408,249 acres; it is thus appropriated:—arable land, 563,979 acres; grass land, 159,560; vineyards, 342,858; woods, 263,544; orchards, gardens, and nursery grounds, 17,434; osier beds, willow plots, &c. 16,458; various cultivation, 67,841; heaths, commons, &c. 806,150; ponds, pools, and ditches, 16,431; rivers, brooks, and æstuaries, 45,782; forests and unproductive lands, 10,333; unascertained, 97,879: total, 2,408,249. The grain chiefly cultivated is wheat; an unusually large quantity of rye is grown, as well as of maize and millet. The rye and millet are raised in such parts of the Landes as have by dint of manure been brought into cultivation. Excellent fruits and a large quantity of hemp are grown. But the staple produce of the department is wine. The finest clarets are from this part of France, as the growths of Lafitte, Latour, Château-Margaux, and Haut-Brion: also Sauterne, Barsac, and the Vins de Grave. The extensive woods which skirt the sea-coast, or pervade the Landes, consist chiefly of the pine (*pinus maritima*), from which turpentine, pitch, and charcoal are procured, as well as timber for building and masts for vessels. The cork-tree is abundant.

The Landes are thinly peopled; the inhabitants make charcoal, or tend the numerous flocks, which obtain scanty food amid these sandy wilds. The shepherds, clothed in sheep-skins, traverse the waste on high stilts, balancing and supporting themselves by the aid of a long staff, of the broad head of which they occasionally make a seat, and which they also use to guide their flocks: they employ their leisure in knitting coarse woollen stockings for their own use or for sale. They travel to markets and fairs on these stilts. Among the sheep of the department are many flocks of merinos, and the proprietors are seeking to extend the long-woolled English breeds.

Divisions, Towns, &c.—This department consists wholly of portions of the former province of Guyenne, or Guienne. It comprehends the districts of Bordelois proper, Médoc, and Landes de Bordeaux, the Captalat de Buch, the districts of Benauge, Entre-deux Mers (between the Garonne and the Dordogne), Libourne, Fronsadois, Cubzagues, Bourges, Blayois, and Vitrezay; all of which are included in Guienne proper, or the Bordelois. It comprehends also the greater part of Bazadois Septentrional, and a portion of Bazadois Meridional, and a very small portion of Agenois. It is subdivided into six arrondissements, as follows:—

Capital.	Population in 1831.	Population in 1836.	Situation.	Area, sq. miles.	Pop. of Arrondts. 1831.	Pop. of Arrondts. 1836.
Bordeaux,	99,062	98,705	Central & W.	1621	245,348	247,748
Blaye,	3,855	3,801	N E.	283	56,406	55,460
Lesparre,	1,309	1,404	N.	466·5	36,918	37,611
Libourne,	9,838	9,714	E.	497	107,514	107,461
Bazas,	4,255	4,446	S.	596·5	53 802	53,721
La Réole,	3,787	3,931	S.E.	306	54,237	53 805
				3770·0	554,225	555,809

The department contains 48 cantons and 543 communes.

In the arrondissement of Bordeaux, beside the capital [BORDEAUX], there are Cadillac, Castres, and Rions, on the Garonne; La Teste (or Tête) de Buch (population 2595 town, 2840 commune), on the bay of Arcachon; Castelnau de Médoc, Macau, and St. Ahon, between the Garonne and the ocean; St. Loubes and Créon, between the same river and the Dordogne; and St. André de Cubzac, north-east of the Dordogne. These are all places of little importance. Cadillac has old embattled walls and an antient castle, built by one of the dukes of Epernon. The fort of Médoc, in conjunction with the town of Blaye and the fort Paté de Blaye, guards the passage of the Gironde, and defends Bordeaux from an attack by sea.

In the arrondissement of Blaye there are only the capital [BLAYE] and Bourg, on the Garonne. [BOURG.]

In the arrondissement of Lesparre, there are the capital, between the Landes and the Gironde, and Castillon on the Gironde. At the northern extremity of this arrondissement, on a rock at the entrance of the Gironde, is the tower

and lighthouse of Cordouan; it is above 160 feet high; the light may be seen above twenty-five miles off in calm weather.

In the arrondissement of Libourne are the capital [LIBOURNE], at the junction of the Dordogne and the Isle; St. Foy (pop. 2612), Castillon (pop. 2528 town, 2897 commune) [CASTILLON], and Bran, on the Dordogne; Coutras [COUTRAS], and Guitres, on the Isle; St. Amillion, Rausan, Pujols, and Gensac.

In the arrondissement of Bazas, beside the capital [BAZAS], there are Langon (pop. 2051 town, 3586 commune), on the Garonne; Villandrau, on the Ciron, a small tributary of the Garonne; Grignols, Captieux, and Uzeste. Langon, in the midst of the district which produces the *Vins de Grave*, is a tolerably well-built town of some trade. There is a regular communication with Bordeaux by means of steam-boats. At Uzeste (or Ozeste) is a Gothic church erected by Pope Clement V.

In the arrondissement of La Réole are the capital, on the Garonne; Gironde and St. Macaire, on or near the same river; Monségur, on the Dropt; Sauveterre, Castelmoron, Pommiers, St. Ferme, Blasimont, and Pellegrue. La Réole is on a hill; an old tower which commands the town is the only remains of a castle said to have been built by the Saracens.

The population of the towns, where not otherwise noticed, is from the return of 1831.

The department is the seat of considerable trade; Bordeaux is one of the principal ports of France. There are some iron-works.

The department constitutes the archiepiscopal diocese of Bordeaux. It is comprehended in the jurisdiction of the Cour Royale, and in the circuit of the Académie Universitaire of that city. It is in the eleventh military division, of which the head-quarters are at Bordeaux. It sends nine members to the Chamber of Deputies.

In respect of education, the department is very little above the average of France; there are among the inhabitants several Protestants, who have three consistorial churches, and a few Jews.

This department returned several of the most distinguished members (Vergniaud, Guadet, and Gensonné) to the National Assembly of 1791; whence the party to which they were attached took the name of Girondins or Girondists.

GIRONDI'NS was the name given to a political party which formed a section of the second National Assembly of France, called 'Legislative,' in contradistinction to the first or 'Constituante,' which framed the constitution of 1791. The members of this party were mostly returned by the departments of the west and south; and as their leaders, Vergniaud, Guadet, Gensonné, &c., represented the department of La Gironde (Bordeaux), the party took the name of Girondins. They showed themselves from the first hostile to the monarchy, and they stood opposed to the constitutionalists, who wished to maintain the constitution of 1791. [FAYETTE, LA.] The Girondins were republicans, who had formed notions of liberty on classical models, such as they were then conceived by ardent young men. They had among them some brilliant orators, and several accomplished and amiable individuals; but as a political party they placed themselves in a false position, and they did great mischief to others. By their opposition to the constitutionalists they weakened the strength of the middling classes, and left the field open to those who, like Danton, addressed themselves to the passions of the lower orders. They at one time obliged the king to choose a ministry from among themselves, including Roland, Servan, Clavière, and Dumouriez, and they seemed for awhile reconciled to the constitutional monarchy; but a schism broke out among them, and they resigned. Soon after came the scenes of June and August, 1792, which the Girondins indirectly sanctioned, and which destroyed the monarchy in France. In the convention the Girondins for the most part voted for the death of the king; they tried indeed to obtain a reprieve for him, but in this they failed. They then began to feel their weakness; they struggled for several months against the ascendancy of the Montagne or Terrorist party, which was supported by the mob; the Girondins wished for legal forms, they denounced the popular massacres, but they had no support out of doors to depend upon. At the same time they excited the republican enthusiasm of the French, and it was Brissot, one of their leaders, who proclaimed the principle of democratic proselytism, afterwards sanctioned by the Convention, by its decree of the 17th December, 1792, by which 'the people of every country which was entered by the French troops were invited to form themselves into a democracy, under pain of being treated as enemies should they prefer to retain their antient form of government.' But all this enthusiasm turned to the profit of the Terrorists at home, who were the men of the lower classes, which the Girondists were not. The latter endeavoured to create an opposition in the departments, to counterbalance the influence of the Paris demagogues, but they were denounced as wishing and conspiring to split France into as many republics as there were departments. At last, on the 31st May, 1793, the convention was assailed by armed multitudes, demanding the imprisonment of twenty-nine deputies of the Girondin party. The Assembly was obliged to give them up, and on the 31st October following twenty-one of them were executed, including Vergniaud, Guadet, Gensonné and Brissot. Others were beheaded afterwards. A few escaped, and reappeared again in the convention after the fall of Robespierre. Dumont, in his *Recollections of Mirabeau*, ch. 18-20, gives some vivid sketches of several of the leaders of the Girondins.

GIRONS, ST., a town in France, capital of an arrondissement in the department of Arriège. It is on the right bank of the Salat, one of the tributaries of the Garonne, and amid the branches of the Pyrenees. It is a handsome and busy place, with a population (in 1831) of 3634 for the town, and 4381 for the commune. A considerable quantity of linens and coarse woollens, and of paper, is made; and great trade is carried on with Spain in swine, mules, wool, iron, &c.; the returns being chiefly in articles of gold and silver. There are ten considerable yearly fairs; at that on the 2nd of November, which is the most considerable, much cattle, corn, linens, and woollens are sold. The environs yield grey marble, quartz, and slates. There are in the town a high school, a subordinate court of justice, and other public offices.

The arrondissement is divided into six cantons, and comprehends 82 communes, with a population (in 1831) of 89,476.

GIRVAN. [AYRSHIRE.]

GIU'LIO ROMA'NO, one of those master-spirits whose talents have earned them renown in various and very opposite departments of art, would be placed among the eminent architects of his age, were it not that his reputation as a painter has absorbed that belonging to him in the other capacity, in like manner as his family surname, Pippi, is almost forgotten in the one which assigns as his proper place this volume of our work. He was born at Rome in 1492, and at an early age it was his good fortune to become the scholar of Raffaelle, of whom he was the favourite pupil, and whose successor he may justly be considered. He assisted that great master in very many of his works, particularly in the celebrated Battle of Constantine, and other frescoes in the *stanze* of the Vatican, where he seems to have wrought with a congenial spirit, and to have been inspired by the conceptions of his instructor and guide. So great was the attachment of the latter to him, that at his death he made him his chief heir, and further directed that all his unfinished works should be completed by Giulio. His name therefore is in some manner linked with that of the greatest of modern painters. From him too Giulio imbibed a taste for architecture, in which art his proficiency was such that it was as much in the capacity of architect and engineer as that of painter that he was, after the death of Raffaelle, invited by Frederic Gonzaga to Mantua, for the purpose of conducting the various works which that prince had projected for the improvement and embellishment of his capital. At Rome he had already erected several buildings remarkable for their taste, including the Villa Madama, the Villa Lante, and the two small palazzi, Alberini and Cenci; the casino belonging to the first-mentioned of which has always been greatly admired by artists for the invention and classical elegance shown in its arabesques and other decorations.

Arrived at Mantua he found an ample and varied field open to his talents, being called upon to exercise them on works of the most opposite character, from those whose merit lay in scientific skill and construction to those which afforded him an opportunity of displaying his fancy in their elaborate embellishment. Among the former were those for draining the marshes, and securing the city from the inundations of the Po and Mincio; and among the latter, the decorations and spectacles got up on the occasion of the Emperor Charles the Fifth's visit to Mantua. But that of the greatest note was the palace called the Te, of which he was not only the architect, but adorned the apartments with

a variety of admirable stuccoes and paintings executed by himself and his pupils. The building itself indeed is rather plain externally, being a simple square of about 190 feet, and of rather low proportions, as it consists of only a single order (Doric), comprising two ranges of windows, the upper one of which is a mezzanine. The whole is sufficiently sober, for the windows are without dressings; neither is there any other embellishment besides the order itself and the rusticated surface of the walls. The simplicity which reigns throughout is further increased by the entablature being carried quite unbroken along the whole extent of front, which it terminates, there being neither attic nor balustrade above it. Yet if in respect to its exterior this edifice does not offer much for description, it would require a large volume to enumerate and explain all the various decorations of the interior—the profusion of stuccoes, friezes, and frescoes, with which the different apartments are adorned. One of the most remarkable is that named the *Sala de' Giganti*, the walls being entirely covered with figures representing the defeat of the Titans—a subject treated by him with such astonishing energy that Giulio has here shown himself equal to the style of Michel Angelo; while in the series representing the history of Psyche he has emulated Raffaelle. Unfortunately both these works have been so retouched and repaired, that they now exhibit very little of the original execution, and therefore show only their design and composition, and the poetical genius of their author, which, according to Reynolds, he possessed in a much higher degree than any other artist before or since. Even the embellishment of this palace alone would appear to have been nearly the work of an entire lifetime; and such indeed it must have proved had not Giulio contented himself with giving his designs and cartoons to be copied by his pupils, which being done, it was his practice to go over the whole of each painting, correcting it and finishing it up until he had stamped it with the character of his own pencil.

Besides the edifices already mentioned, he restored or embellished various churches at Mantua, and especially the cathedral, which, although comparatively seldom spoken of, is one of the finest buildings of its kind in all Italy. Giulio however did not live to see it finished, but it was completed after his death by his pupil Bertano. This last-mentioned event took place in 1546, as he was on the point of quitting Mantua; for notwithstanding the high repute and favour he enjoyed there, his ambition tempted him to accept the offer of succeeding Sansovino as the architect of St. Peter's, although he had previously refused the pressing instances of Francis I., who was anxious to engage him in his service.

Giulio was by no means so happy in colouring as in design and invention, which, if occasionally rather forced and extravagant, were for the most part highly noble. He chiefly excelled in mythological subjects, nor was he always very scrupulous in treating them, many being exceptionable on account of their voluptuousness. Indeed it is said that his chief inducement at first for removing to Mantua was to abscond from Rome, where he was implicated in an affair that will ever be a blot in his character, it being reported that he had furnished the engraver Marc Antonio Raimondi with a series of infamously obscene drawings for as many sonnets of Aretino. Raimondi was thrown into prison; and had he remained at Rome Giulio would in all probability have shared the same fate, and not undeservedly.

While at Mantua he formed a sort of school, the most eminent of which were Primaticcio and Rinaldo Mantovano.

GIVET. [CHARLEMONT.]

GIZEH, or JIZEH. [EGYPT.]

GIZZARD, the muscular or pyloric division of the stomach in birds. In these animals the stomach is divided into two parts. The lower œsophagus (the canal which is continued from the crop to the stomach) first dilates into a cavity called the 'proventriculus,' or glandular division of the stomach; this has a very vascular lining membrane, and is furnished with numerous large follicles, or glands, placed between the mucous and muscular coats, which secrete a solvent fluid very similar to the gastric juice in mammalia. This first division of the stomach mostly terminates immediately in the gizzard, which is situated below the liver, on the left side of the abdomen, resting on the intestines. This organ has more or less a lengthened form, and is furnished at its upper part with two openings, the cardiac and pyloric, which are close together; the former communicates with the 'proventriculus,' and the latter with the intestines. Below those openings the gizzard dilates into a pouch, in the middle of the anterior and posterior sides of which is a tendon to which muscular fibres are attached. In birds of prey, whose food is easily digested, the gizzard is a mere membranous cavity; but in graminivorous birds it is furnished with muscles of great power, which are arranged in four masses; the two largest, which are situated anteriorly and posteriorly, are connected with the central tendons, and are called the digastric muscles; between these are two thinner ones.

The lining membrane of the gizzard is very hard and thick, and opposite to the digastric muscles two callous spots are formed by the pressure and friction. The muscles take up so much room in the stomach of graminivorous birds that the crop is a necessary appendage to the gizzard, and transmits the food, little by little, to be digested. The food is triturated in the gizzard by the immediate agency of hard foreign bodies, as sand and gravel, which the birds swallow; these bruise the grains of corn by the action of the muscles, and deprive them of their vitality, when the gastric juice acts upon and dissolves them. The pebbles thus perform the vicarious office of teeth.

Hunter inferred that the action of the great digastric muscles of the stomach in birds was rotatory, and says, 'Although the motion of the gizzard is hardly visible, yet we may be made very sensible of its action by putting the ear to the side of a fowl while it is grinding its food, when the stones can be heard moving one upon another.' The pyloric or intestinal orifice of the gizzard is furnished with a valve, which is of considerable size in those birds which swallow large stones, as the ostrich; it prevents them from passing into the intestines, and it also keeps the food in the stomach until it has undergone a sufficient degree of trituration or mastication to fit it for nutrition.

GLACIERS, a French word received into our language, and which must not be confounded with *glacière*, which has a different signification.

The glaciers, as defined by Saussure, are those eternal masses of ice which are formed and remain in the open air in the valleys and on the slopes of lofty mountains.

In speaking of glaciers, we generally refer to those of the Alps, as being the best known, though there are many in other places. The glaciers of the Alps have been frequently described by travellers, geographers, and naturalists, but by none in so much detail as by Saussure and Gruner.

General view of the Glaciers of the Alps.—If, says Saussure, a spectator could be placed at a sufficient height above the Alps, to embrace at one view those of Switzerland, Savoy, and Dauphiné, he would see a mass of mountains intersected by numerous valleys, and composed of several parallel chains, the highest in the middle, and the others decreasing gradually as they recede. The central and highest chain would appear to him bristled with craggy rocks, covered, even in summer, with snow and ice in all those places that are not absolutely vertical; but on both sides of the chain he would see deep and verdant valleys, well watered and covered with villages. Examining still more in detail, he would remark that the central range is composed of lofty peaks and smaller chains, covered with snow on their tops, but having all their slopes that are not very much inclined covered with ice, while the intervals between them form elevated valleys filled with immense masses of ice, extending down into the deep and inhabited valleys which border on the great chain. The chain nearest to the centre would present to the observer the same phenomenon, but on a smaller scale, beyond which he would see no more ice, nor even snow, save here and there on some of the more elevated summits.

Of the division of Glaciers into two kinds.—From what precedes, continues Saussure, I recognise two kinds of glaciers, quite distinct from each other, and to which all their varieties may be referred. The first are contained in the valleys more or less deep, and which, though at great elevations, are still commanded on all sides by mountains higher still; while the second are not contained in the valleys, but are spread out on the slopes of the higher peaks.

The distinguishing features of the two kinds, are the greater extent and depth of the former, and the greater compactness of the mass; but as these circumstances seem to depend on the situation of the glaciers, as is proved by the insensible passage of the one kind into the other in many localities, the distinction of Saussure seems to have little foundation.

Origin and Formation of the Glaciers.—The formation of the glaciers, whatever are their position and appearance, is due to the great quantity of snow which falls in the high and cold regions of the mountains, and which the heat of summer can but partially thaw. When the slopes of the lofty peaks are very rapid, the snow, being unable to rest upon them, slips down into the valleys in the form of avalanches; and this being added to what falls directly into the valleys, there is accumulated an enormous quantity that becomes compressed by its own weight. This snow is subsequently converted into a kind of ice by the following process:—The rains which occasionally fall, and the water resulting from the partial melting of the snow in the warmer months, percolates the mass, steeping it throughout; and in this state, being seized by the cold of the succeeding winter, it is consolidated into a glacier. It will however be easily conceived that the ice so formed is very different from that found in ponds or lakes; it has neither the hardness, the compactness, the solidity, nor the transparency of the latter, but is, on the contrary, porous and opaque. The water, in filtering through the mass, not being able to drive out all the air lodged in its interstices, this air, together with that which is liberated during the subsequent congelation, collects into bubbles of various forms and sizes, destroying the transparency and cohesiveness of the mass. With regard to the snow which rests on the slopes, it is evident that it will be subject to the same effect of rain and warmth as that in the valleys, but, from the very position in which it lies, the water in great part runs off, or is only retained towards the bottom of the slope, whence it results that the glaciers so situated are in general of much looser texture than the glaciers of the valleys. It is only towards the bottom, where the water accumulates, that the ice of the former acquires a consistence equal to that of the latter. This solidity decreases as you ascend, till towards the top there is nothing but snow.

Surface of the Glaciers.—The surface of the glaciers depends entirely upon the ground on which they rest. When the bottom is even, or but slightly inclined, the surface of the glacier, though rough and granulated, is also even, presenting but few crevices, and these not wide; but in proportion as the bottom is inclined or rugged, the surface is abrupted and uneven. Ebel, who follows Saussure, says, that wherever the slope exceeds 30 or 40 degrees, the beds of ice break into fragments, which get displaced, upheaved, and piled together in every variety of fantastic form, and exhibit immense chasms many feet in breadth, and often more than 100 feet deep.

Splitting of the Ice, and Character of the Chasms.—The splitting of the ice on a change of weather, or in consequence of unequal pressure on an uneven bottom, shakes the very hills, and produces a noise which, reverberated from the mountains, sounds like thunder. The breadth and depth of the chasms thus occasioned vary considerably according to circumstances. Sometimes their dimensions are rapidly increased, either from the slipping away of the lower mass while the upper remains stationary, or in consequence of the erosion of the water running down them from the thawing of the surface; and at other times they are suddenly closed up by the descent of the upper portion against the lower, which is fixed. The ice at those fissures down which the water flows freely is generally transparent, and is observed to be of a greenish colour towards the top and bluish towards the bottom. These clefts are frequently hidden by a covering of snow, which renders them exceedingly dangerous.

The Moraines of the Glaciers and Central Banks.—Along the anterior edge and lateral margins of some of the larger glaciers there are masses of debris accumulated into the form of long dykes or parapets, which in the Tyrol are known by the name of *trockne muren*, and in Savoy by that of *moraine*, which has more generally prevailed. In Iceland, where the glaciers are called jokül, the moraines are named *jokülsgiärde*. The formation of the *moraines* is easily conceived. When the rocks bordering the glaciers are themselves bare of snow or ice, in consequence of the rapidity of the slope, and are schistose or stratified, they are easily disintegrated by the alternate action of wet and frost, heat and cold, and the fragments thus detached roll down to the lateral edges of the glacier, where the greater part is stopped, while some isolated blocks are urged farther towards the middle. The general inclination of the glacier and its progressive motion downwards also collect a quantity of these débris along the anterior boundary of the ice-field, so that in some cases the whole glacier is entirely surrounded by a moraine. Wherever the mountain-slopes are protected by a glacier of their own, or where the rock is of compact indestructible granite, no moraine is formed. Thus it happens that some glaciers have a moraine on each side, others on one side only, and some none at all. Occasionally also a moraine is found where none could have been formed, in which case it is one that has been brought down from a higher station by the motion of the glacier, as is evident from the nature of the débris. These moraines sometimes attain a height of a hundred feet. It is observable however that when the glaciers have diminished in size, the moraine is above the ice-field; and when, on the contrary, the glacier has increased, the moraine is lower than the ice, and in some cases the moraine and the ice are on a level.

M. Agassiz, of Geneva, in a paper on glaciers, moraines, and erratic blocks, published in the 'Bibliothèque Universelle,' No. 24, 1837, has called attention to the existence of moraines at the height of several hundred feet above the bottom of the superior Alpine valleys, where there are no longer any glaciers; but in descending into the lower valleys they are found in succession as high as twelve, fifteen, and eighteen hundred feet. They may even be observed at two thousand feet above the bed of the Rhône, in the neighbourhood of St. Maurice, in the Vallais, and can also be traced at a great height round the lake of Geneva: from this fact and other collateral circumstances M. Agassiz concludes that at one time the glaciers covered the whole of the plains of Switzerland to a height of 3,300 feet above the level of the sea, or 2,155 feet above the present surface of the lake of Geneva, and extended as far as the Jura. To account for the existence of such masses of ice he supposes the alternate cooling and heating of the globe at distant but given periods. He appeals to fossil remains in confirmation of his theory, and tries to explain the existence of the erratic blocks of the Jura by supposing them to be the transported moraines of his immense glaciers.

Besides the bordering moraines, there are long and high ridges formed of fragments of rocks, boulders, sand, and earth, in the middle of the glaciers, and at a considerable distance from the margins, to which however they are generally parallel. These banks, which in the German cantons of Switzerland are called *guferlinien*, are sometimes numerous and high. Thus, in traversing the great ice-field above Montanvert, Saussure crossed four or five of them which were 30 or 40 feet high, an elevation due in part to the quantity of the débris, and in part to the sinking of the surrounding ice, which thaws, while that under the heap, sheltered from the sun, remains unthawed. The glacier of Rosboden is said to exhibit the greatest number of these ridges, and of the largest dimensions. The formation of these banks is thus explained. The glacier progressively slipping down upon the inclined bottom of the valley, recedes from the sides, carrying part of the lateral moraine along with and upon it. This retreat often leaves a considerable space, particularly in the wider valleys, between the foot of the mountains and the edge of the glaciers, which space, during the succeeding winter, becomes filled up with fresh snow, which is converted into ice by the process already described, and on which a new moraine is collected. This recedes like the first, and so on; so that were it not that the moraines of the opposite sides sometimes become confounded into one, and because the motion of the ice on the irregular slopes of the valley disturbs the order and parallelism of the banks, they might serve to determine the age of the glaciers.

Ice Caverns and Torrents of the Glaciers.—In winter, as well as in summer, there is continually a quantity of water flowing out from the lower parts of the glaciers, though much less abundantly in the former than in the latter season. This water proceeds from the thawing of the under surface of the glacier, occasioned by subterraneous heat. In the winter it oozes from under the ice in small streamlets; but in the spring and summer months, when it is greatly increased in quantity, it bursts away the ice from before it, and gushes out in plenteous streams from the caverns it has excavated; some of these grottoes are 100 feet high, and from 50 to 80 feet wide, presenting very various and sometimes highly picturesque appearances. The torrents of the glaciers are remarkable for the whitish-blue colour of their waters, which they maintain for a distance of some leagues.

Wind of the Glaciers.—This phænomenon, which the Germans call *gletschergeblase*, results from the sudden escape of the air imprisoned beneath the glaciers. On a change of temperature this escapes through the crevices in strong currents of insupportably-cold wind, driving like snow-dust the fine icy particles with which it is loaded.

Descent of the Glaciers.—All the Alpine valleys being inclined plains, it is natural to suppose that the glaciers must slip down by their own weight, whenever any circumstance destroys their adhesion to the sides and bottoms of the valleys. This adhesion is constantly diminished, even in the depth of winter, by the natural warmth of the earth, which thaws the under surface of the glacier; but as this takes place only in those parts where the great thickness of the ice protects the soil from the effects of external cold, the mass, by this action is but partially disengaged, and therefore still maintains its position. But when the warmth of summer heats the soil all around, and thaws the ice at its surface and edges, the liberation of the glacier goes on with rapidity, aided as it is moreover by the erosion of the underflowing currents, and the abrasion of the lumps of ice and the stones which they bear along. Then it is that the whole mass, obeying the impulse of gravity, slips down and invades the fertile valleys below, presenting the singular spectacle of an ice field terminating on flowery meadows and contiguous to rich harvests. The limits which the descending glaciers attain are subject to variation.

Increase and Diminution of the Glaciers.—Notwithstanding the immense accession of snow and ice which the glaciers receive every winter, and which is much greater than what could possibly be thawed by the mere effect of a short summer in the higher Alpine regions, it is found that they have not sensibly increased. If for one or a few years in succession some of the glaciers are observed to descend lower than usual, they are found in the following years to recede proportionably; thus they are confined within certain limits by a compensating process of nature. The evaporation from ice, and particularly from snow, is considerable even in winter, and goes on with great rapidity in a dry and rarefied air; and subterranean heat, as we have already observed, produces throughout the year a certain diminution of the glaciers at their under surface. In the summer the general thawing of all the parts exposed to the direct rays of the sun, to the warm atmosphere, and to the heated soil at the edges of the glaciers, tends greatly to diminish the quantity of ice; an effect increased by the mechanical action of the torrents which this thawing occasions. But all these causes, powerful as they are, would be insufficient to prevent a constant though gradual increase of the ice, were it not for the advance of the glaciers into the warm atmosphere of the lower valleys. The greater the increase of the preceding winter, the greater the pressure from above, and the lower the glacier slips into the thawing region. The farther it slips, the greater space is left behind to be filled up, and consequently the greater time must elapse before the mass can again be urged forward. During this time, the lower extremity, subjected to the heat of two or three summers, recedes as much as or more than it had before advanced, and thus an admirable compensation is established, by which the cultivated lands of the lower valleys are secured against the unlimited encroachments of the glaciers.

Extent of the Glaciers.—The number and extent of the Alpine glaciers is very considerable. From Mont Blanc to the borders of the Tyrol there are reckoned about 400 glaciers, of which a very few are only three miles in length; the greater number range from ten to fifteen miles long, and from one to two miles and a quarter broad. The thickness of some of the glaciers is also very considerable, being from 100 to 600 feet.

It is calculated that the glaciers of the Tyrol, Switzerland, Piedmont, and Savoy form together a superficial extent of 1484 square miles. Such are the great reservoirs whence some of the principal rivers of Europe draw their inexhaustable supplies. It is observable that there are but few glaciers in the direction of east and west.

The above account refers chiefly to the glaciers of the Alps; but as all glaciers, wherever they may be, have the same origin, it is presumable they are also subjected to like influences and present similar phænomena.

The Pyrenean chain, as also the Sierra Nevada, have glaciers, though they are almost all on the northern slopes, there being none on the southern declivities, except in such places as are sheltered from the sun and south wind by other and more advanced mountains. In the mountains of Norway there are several glaciers. Spitzbergen has its eminences covered with snow and surrounded by glaciers.

In Iceland the glaciers are both numerous and extensive; they generally hang on the rapid slopes of the mountains, and sometimes wholly encase them. These ice-clad elevations are termed Jokülls, the principal of which is that named Klofa Jokül, in the eastern quarter of the island, and which, according to Henderson, forms, with little or no interruption, a vast chain of ice and snow mountains not less than 3000 miles square. Another, called Blafell's Jokül, extends from near Tindafiall 100 miles across the island in a westerly and northerly direction, and, near the Lake Hvitârvatn, presents the most magnificent glaciers. There are numerous other glaciers; many of them, besides the usual phænomena, exhibiting marks of the extraordinary convulsions occasioned by volcanic action and the emission of hot water from the sides of the mountains.

Greenland, as far as is known, contains innumerable glaciers, many of great thickness; and the inhabitants of both the east and the west coast are persuaded of their continual increase. It is remarkable that although Graah, in his account of Greenland, describes the glaciers as formed in the same manner with those of the Alps, yet he and all travellers notice the beautiful transparency and consequent compactness of the northern glaciers, and of the icebergs which have been detached from them; a circumstance which seems to denote some peculiar modification of the process of their formation.

Along the south-west coast of South America there are extensive glaciers, as also in the strait of Magalhaens, and in Tierra del Fuego. They are described by Captain P. P. King, and laid down in many parts of the chart published from the Survey of the Adventure and Beagle. (*London Geog. Journal*, vol. i.)

Dr. Gebler, in the summers of the years 1833, 1834, and 1835, paid much attention to the formation and movement of the glaciers of the Altai mountains; and it is worthy of notice that his observations coincide with those obtained in the Alps by Saussure and others.

GLACIS, an elevation of earth surrounding a fortress on the exterior of the covered-way, to which it serves as a parapet. [S, S, *fig.* 1, BASTION.]

Its crest is eight feet above the terreplein of the covered-way, and its superior surface, which descends with a gentle slope towards the country, meets the natural ground at about fifty yards from the covered-way.

The glacis, by forming an inclined plane ascending towards the fortress, serves to expose the approaches of the besiegers, when they arrive near the place, to the fire of artillery from the bastions or ravelins; and a banquette, or step, at the foot of its interior slope, enables the defenders to graze its superior surface by a fire of musketry.

Any elevation of earth beyond the ditch of a fortress, and forming an inclined plane descending towards the latter, is called a reverse or counterslope glacis.

GLADIATORS were men who fought with swords, gladii, and other weapons, and wounded and killed one another in the circus, the amphitheatre, and other public places, for the entertainment of the Roman people. They were either slaves, prisoners, or convicts, and as such obliged to fight; or volunteers, who exhibited for money. There were establishments in the Roman towns, in which the gladiators were boarded and taught their art, and in which a certain number of those who had been trained were always kept in readiness for the fight. Their master and keeper was called Lanista. When a wealthy man wanted to give a gladiators' fight, either at a funeral or on any other public or private occasion, he bargained with the Lanista for a certain price to give him so many pairs of gladiators. Out of each pair one was to die, if so required by the spectators. When a gladiator was severely wounded, so as to be unable to fight any longer, his antagonist stood over him with his sword ready to kill him, and looked up to the assembly for its fiat. If the majority turned their thumbs downwards, that was the signal of death. The origin of this barbarous custom seems to have been derived from the practice of killing a certain number of captives at the funeral of a chieftain. Homer represents Achilles as sacrificing twelve young Trojans at the funeral of his friend Patroclus. Afterwards, instead of butchering the prisoners like so many cattle, it was thought better to make them

fight round the funeral pyre, when the conquerors had a chance of escaping with their lives. By degrees the custom was extended to all great festivals, for the amusement of the spectators, and the waste of human life thus wantonly sacrificed was increased to a fearful extent in the later times of the Roman republic and under the empire. The practice was defended even by grave men, and Cicero among the rest, as serving to keep up a martial spirit and a contempt of death among the people. It certainly contributed to render the people ferocious and cruel. Constantine prohibited gladiators' fights by an edict (*Cod.* xi., Tit. 43), but the practice, it is said, was not totally extinct in the West till the time of Theodoric. The Greek republics did not adopt the custom of gladiators' fights. It was a practice essentially Roman, and the Romans are said to have adopted it from the Campanians, who had gladiators' fights even at their banquets. (Lipsius, *Saturnalia;* Ferrari Octavius, *Dissertatio de Gladiatoribus.*)

Rome was at one time near paying very dearly for this inhuman pastime. In the year 76 B.C. seventy-four gladiators at Capua rose against their master, overpowered the guards and fled to the mountains, where they were joined by a number of runaway slaves and peasants, to the number of several thousands. Being led by a gladiator of the name of Spartacus, a Thracian by birth and a man of superior abilities, they defeated several Roman armies, overran Campania, Lucania, and other provinces, took and plundered Nola, Nuceria, and other towns, and spread alarm almost to the gates of Rome. But dissension grew up among their ranks. One portion of them, chiefly Gauls, separated from the rest under one Crixus, and were defeated and cut to pieces by the consul Gellius. Spartacus, who was on his march towards North Italy, having retraced his steps on hearing this news, defeated Gellius, as well as the other consul Lentulus, and then fortified himself in the mountains of Lucania. He performed a solemn funeral in honour of Crixus, who had fallen in battle, and obliged 300 Roman captives to fight as gladiators round the pyre. The war lasted three years, at the end of which Spartacus was defeated by the prætor M. Crassus, and was killed after performing prodigies of valour. (Livy, *Epitome,* 95—97; Eutropius, b. 6.) [CRASSUS.]

There are several antient statues, highly praised for their workmanship, which represent or are supposed to represent gladiators in several attitudes. One of the best is the 'Fighting Gladiator' of the Borghese collection, now in the Museum of the Louvre. The 'Dying Gladiator' of the Capitoline Museum has furnished Byron with the subject of one of the finest stanzas of his 'Childe Harold:' 'I see before me the Gladiator lie.'

GLAMORGANSHIRE, a maritime county of South Wales, lying between 51° 23′ and 51° 48′ N. lat., and 3° 3′ and 4° 18′ W. long. This county is bounded on the north by Brecknockshire and Caermarthenshire, on the east by Monmouthshire, and on the south and west by the Bristol Channel. Its form is irregular: the greatest length is from east to west, from Llanvedw bridge over the Rumney to the headland between Rossilly Bay and the river Burry, 52 or 53 miles; its greatest breadth, from the head of the river Romney to the coast near Sully island, 27 miles. The area is estimated at 792 square miles; it is the third of the Welsh counties in respect of size, being exceeded by Caermarthenshire and Montgomeryshire. Its population in 1831 was 126,612, or 160 to a square mile, which is far above the average of Wales, but considerably below the average of England. In absolute population it is the first of the Welsh counties; in relative population it is exceeded by Flintshire and Anglesey. Cardiff, which is the county town, is about 131 miles in a straight line west of London, or 166 miles by the road through Reading, Marlborough, Calne, Chippenham, Bath, Bristol, and (by the old passage over the Severn) Chepstow and Newport.

Coast-line, Islands, &c.—The line of the Glamorganshire coast, from the mouth of the Rumney, where it adjoins Monmouthshire, to Pennarth harbour, formed by the æstuary of the Taafe and the Ely, is marshy. From Pennarth Point, on the south side of the harbour, to Lavernock Point (between which the coast runs southward), are high cliffs, which continue with a few interruptions from Lavernock Point (where the coast turns westward) to Nash Point; and from Nash Point, where the coast turns to the north-west, to Sker Point. About midway between Lavernock and Nash Points is Breaksea Point, the most southerly part of the county. Between Lavernock and Breaksea Points are Sully Island and Barry Island, both small. Barry Island, the larger of the two, is joined to the mainland by an isthmus, or causeway, dry at low water; it is nearly surrounded by cliffs; it is about a mile and a half in compass, and contains about 300 acres of land, occupied by a farmer, but for the most part retained in the state of a heath or warren for rabbits. The island is supposed to have derived its name from St. Baruch, a Welsh saint, who is said to have died here about A.D. 700. Leland, who has described the island, says, 'Ther ys no dwelling in the isle, but ther is in the midle of it a fair little chapel of St. Barrock, wher much pilgrimage was used.' The cliffs along this part of the coast and in Barry Island are chiefly composed of lias, except those in the neighbourhood of Sker Point, which are chiefly of mountain limestone.

From Sker Point to the Mumbles the line of coast forms Swansea Bay. There are no cliffs here; the coast is comparatively low, and skirted by broad sands, dry at low water. At the Mumbles, which are small rocky islets just off shore, the limestone cliffs recommence, and continue with some interruptions along the line of coast, which runs westward to Worms Head, forming the three small bays, Caswell, or Cashwell Bay, Oxwich Bay, and Portlynon, or Port-y-nan Bay, with the three points, Poldye, or Pwldye Head, Oxwich Point, and Portlynon, or Port-y-nan Point, at their respective western extremities. At Worms Head the coast turns northward to the point opposite Holmes Island, a small islet at the entrance of the Burry river (or rather æstuary), forming the shallow bay of Rossilly. From the point opposite Holmes Island the shore of the Burry æstuary runs eastward, making the western part of the county a narrow peninsula, called Gower. The river Loughor, which runs into the Burry, forms the boundary of Glamorganshire and Caermarthenshire. The shore of Rossilly bay is low, that of the Burry is marshy; both are skirted by broad sands, dry at low water. Whitford Point is a small headland of the peninsula of Gower, jutting out for a mile or two into the Burry. There are some small islets off Port-y-nan Point and Worms Head, and some sand-banks. The length of the coast, following its principal windings, may be estimated at eighty-nine miles.

Surface: Hydrography: Communications.—Glamorganshire is covered with mountains, some of which branch off from the principal range that extends east and west through Brecknockshire into Caermarthenshire. The centre of the county is occupied by a group of mountains branching off in every direction except the north, and having its chief extension from east to west from the valley of the Cynon to that of the Neath. The highest mountain in the county, Llangeinor (1859 feet high), from which some of the principal tributaries of the Ogmore flow, belongs to this group. Margam Down, 1099 feet high, is near the east side of Swansea bay. Great Garth (981 feet) is near the Taafe, between Llantrissent and Caerphilly. Cefn Bryn (583 feet) is in the peninsula of Gower: and Ogmore Down (292 feet) is near the mouth of the Ogmore.

The general course of the streams is from north to south. The larger streams have their sources in the high lands of Caermarthenshire and Brecknockshire, all within a distance of less than thirty miles of each other, but they diverge as they flow towards the coast. The smaller streams rise in Glamorganshire itself, and flow either into the larger ones or into the sea.

The Romney rises just at the north-east extremity of the county, which, to its outfal, it separates from Monmouthshire. Its whole course is about 30 miles: it is not navigable, nor does it receive any tributary which requires notice. It is variously spelled Remney, Romney, and Rumney.

The Taafe, Taff, or Tâf, the largest river in the county, rises in Brecknockshire, between the mountains Capellante and the Van, or Beacon of Brecon, and flows south-south-east past Merthyr Tydvil, Llandaff, and Cardiff, into Pennarth harbour, which is formed by the joint æstuary of this river and the Ely. The whole course of the Taafe is about 38 or 40 miles. Its chief tributaries are the Taafe Fechan, or Little Taafe, 12 miles long, which rises in Brecknockshire, and joins the Taafe on the left bank, just above Merthyr Tydvil: the Cynon, 12 miles long, which also rises in Brecknockshire, and flows through Aberdare into the Taafe on the right bank, seven miles below Merthyr; and the Rontha Vawr, or Great Rontha, which has a course of 12 miles, all in Glamorgan-

shire, and joins the Taafe three or four miles below the Cynon on the right bank. The Ely, or Elwy, may also be considered a tributary of the Taafe, since they have a common æstuary; it has a course of about 20 miles, all in Glamorganshire, and is not navigable.

The Daw, or Thaw, rises near Cowbridge, and flows 10 or 12 miles past that town into the sea. Its mouth forms the little harbour of Aberthaw, close to Breaksea Point.

The Ogmore rises in the central mountain-group of the county, and flows past Bridgend, about 18 miles, into the sea between Nash Point and Sker Point. It receives on its right bank the Garw, and the Llynfi, or Llynvi, which flow from the same group of mountains, and have a course of 7 and 9 miles respectively; and on the left bank, near its mouth, it receives the Ewenny, which has a course of 10 or 12 miles.

The Avon rises on the north side of Llangeinor mountain, and flows south-west 15 miles into Swansea bay; it receives the Corrwg and the Avon Fechan, or Little Avon, both small. It is navigable a mile or two above its mouth for vessels of small burden, employed by the proprietors of some neighbouring copper-works.

The Neath, or Nedd, rises in Brecknockshire and flows south to the border of Glamorganshire: in this part of its course it receives several tributaries. From the border it flows south-west, 15 miles, through Glamorganshire into Swansea Bay. Its whole course is about 23 miles, of which it is navigable for vessels of 200 tons for about two, viz. up to Neath bridge. There is a bar at the mouth with several rocks. It receives only one tributary of any importance in Glamorganshire, the Dulais, or Dylais, which rises in Brecknockshire and has a course of 14 or 15 miles, joining the Neath about two or three miles above the town of Neath.

The Tawe rises in Brecknockshire, and flows south-west through Brecknockshire and Glamorganshire into the sea at Swansea, called by the Welsh Abertawe, the harbour of which is formed by the mouth of this river. Its course is about 26 miles, about half in each county. It has several tributaries, but none of those which belong to Glamorganshire are large enough to require notice.

The Loughor rather belongs to Caermarthenshire; it has the lower part of its course, for 12 or 14 miles, along the border of this county, and is navigable up to the town of Loughor. Its principal Glamorganshire tributaries are, the Lan, or Llan, and the Leu, or Llu. The æstuary of this river is called the Burry, which name it takes from a streamlet of the peninsula of Gower, about 5 miles long, which flows into it. There are several canals in the county.

The Glamorganshire or (as it is sometimes called) the Cardiff canal commences on the east side of the river Taafe, near its entrance into Pennarth harbour, about a mile and a half below Cardiff. Its course is first north, then north-north-west, along the valley of the Taafe, on the east side of the river, passing close by the town of Cardiff to near the junction of the Taafe and the Cynon. Here it is carried over the river by an aqueduct bridge, and is very soon after joined by the Aberdare canal. The remainder of its course is on the west side of the river, to the town of Merthyr Tydvil, near the border of Glamorganshire and Brecknockshire. Its whole length is about 25 miles, with a total rise of 611 feet. At its termination in the tideway of the river Taafe there is a sea-lock, with a floating-dock 16 feet deep, capable of receiving vessels of 300 tons. The line from Merthyr to Cardiff was opened A.D. 1794. This canal is designed chiefly for the export of the coal and iron of the country through which it passes. There are several railroads along its line, connecting it with the mines and coalpits; the Cardiff and Merthyr Tydvil railway runs parallel to the canal, but on the other side of the river, from Merthyr to the aqueduct over the Taafe.

The Aberdare canal is connected with the Glamorganshire canal, near the aqueduct bridge over the Taafe; and runs along the valley of the Cynon, on the eastern side of the river, and nearly parallel to it, to within a mile of Aberdare. Its whole length is 6½ miles, with a total rise of 40 feet. It is designed, like the Glamorganshire canal, for the export of iron, coal, and lime, the produce of the neighbouring mines. From the termination of the canal near Aberdare is a railroad, which extends two miles farther in the same direction.

The Neath canal commences at Abernant, on the north-west side of the river Neath, or Nedd, and runs for some miles parallel to that river, which it crosses about midway between the commencement of the canal and the town of Neath; it then continues, still parallel to the course of the river, but on the south-east side, past the town of Neath, a mile or two below which it terminates in the Neath river. This canal was nearly completed in 1798. It serves for the export of coals, copper, iron, limestone, and other minerals. The Neath canal is about 14 miles long. A branch cut from this canal on the south-east side of the Neath is carried across that river, and runs on the north-west side of it till it terminates in the Britton canal, which is a small canal, a little more than four miles long, cut from the river Neath, opposite to where the main line of the Neath canal opens into it, nearly parallel to the coast into Swansea harbour. The Britton canal is the property of an individual.

The Swansea canal commences in Swansea harbour, and runs along the valley of the Tawe, on the west side of that river, into Brecknockshire. It is about 17 miles long, with a rise of 373 feet: it was opened A.D. 1798. It is chiefly used for the export of the minerals of the country, and the conveyance of copper and other ores to the extensive foundries about Swansea. There are several railroads connecting it with the neighbouring mines.

The Penclawdd canal commences at the village of Penclawdd, on the æstuary of the Burry, and has a crooked course eastward for nearly 4 miles. There are some railroads connected with this canal, which runs through a part of the coal-field of South Wales.

There are several railroads in Glamorganshire. The Cardiff and Merthyr Tydvil railway has been already noticed in connection with the Glamorganshire canal.

The Duffryn Llynvi and Porth Cawl railway commences at the harbour of Pwll, or Porth Cawl, near Sker Point, east of Swansea bay, and runs eastward inland to the valley of the Llynvi, a feeder of the Ogmore; it then follows the valley of this river, on the west side of the stream, to near its head, where it crosses it, and continues its course for a mile or two farther. Its length is nearly 17 miles, and its total rise 490 feet. The object of this railway, as well as of the Bridgend railway, which extends from this to the town of Bridgend, is to facilitate the conveyance of goods, especially of the freestone, limestone, coal, and iron which the district yields.

The Aberdulais railway commences at the branch of the Neath canal, near the junction of the rivers Neath and Dulais, and runs along the valley of the Dulais, first on the west and then on the east side of that river, to the border of Brecknockshire. It is between 8 and 9 miles long, with a total rise of 426 feet.

The Oystermouth railway commences at Oystermouth, near the western extremity of Swansea Bay, and runs along the shore of the bay to the town of Swansea, and thence northward to the coal-pits near that town, sending out several branches. It is designed to facilitate the shipping of the mineral productions of the district.

The railroads which connect the various canals with the mines near which they pass have been noticed. There are others connecting the little harbour of Aberavon with the coal-pits and mines of the vicinity.

The principal coach road is that travelled by the Pembroke, Caermarthen, and Bristol mail. It enters the county from the east by Romney bridge, over the Romney, between Newport (Monmouthshire) and Cardiff, and runs first west, then north-west, by Cardiff, Cowbridge, and Neath to Swansea; from Swansea it runs north-west, and quits this county for Caermarthenshire at the bridge over the Loughor at Pontarddylais. From Cardiff the road leads to Caerphilly, and thence into Monmouthshire; another follows the valley of the Taafe to Merthyr; and another runs north-west to Llantrissent and Bridgend. A road runs from Cowbridge to Llantrissent, Newbridge, and Merthyr. A road from Neath follows the valley of the Neath into Brecknockshire, with a branch near the border of the county to Merthyr. A road from Swansea traverses the peninsula of Gower to Rossilly; and several roads from Swansea communicate with Loughor and with various other places.

Geological Character; Mineralogy.—The uppermost of the formations which are found in this county is the blue lias, which occupies the most southern portion of the county. It forms, with some interruptions, the cliffs which are found from Lavernock Point to the mouth of the Ogmore, and occupies the lower part of the valley of the Ogmore. The lias here is chiefly found filling up the valleys and depres-

sions in the subjacent formations. Its strata are nearly horizontal, except where disturbed by the faults of the lower formations. The cliffs formed by this rock are bold and lofty, and samphire grows more plentifully on them than on any other. In the southern part of the county the newer red marl or red sandstone is also found, especially in the neighbourhood of Cardiff, and along the coast from the Romney to Lavernock Point. The conglomerates associated with this rock predominate near Llandaff and in the vale of Ely. Gypsum is found near Lavernock Point.

The newer magnesian or conglomerate limestone, which is the lowest rock before coming to the coal-measures, is found in several places in the southern part of the county; its thickness varies very much, from thirty feet to as many inches, almost in the same cliff.

The rest of the county is occupied by the coal-measures and the associated beds, the mountain limestone, and the old red sandstone. The coal-measures occupy all the northern part of the county; they are bounded on the south by a line drawn across Gower peninsula from Whitford Burrows to Oystermouth on Swansea Bay, by the shore of Swansea Bay, and by a waving line drawn eastward from Margam on that bay by Llantrissent and Caerphilly to the river Romney. The deepest part of the coal-field of South Wales, to which the district thus limited belongs, is near Neath. The miner finds coal without any considerable descent: for the whole country is intersected with deep valleys in a north and south direction; and the miner, taking advantage of this, drives levels into the adjacent hills and obtains ironstone and coal. There are however many mines in valleys and low places. The lower part of the series of the coal-beds, as worked near Merthyr Tydvil, is distinguished by the predominance of shale; the upper, by the predominance of a coarse grit of loose texture, abounding with specks of coaly matter. Near Swansea an enormous fault, many fathoms thick and filled with fragments of the disrupted strata, traverses the field, effecting a rise, on one side of the fault, of 240 feet in the strata. Near Merthyr, where the coal-field approaches its northern limit, and at the head of the Neath valley, is found a coarse conglomerate of the millstone grit formation, separating the coal-measures from the subjacent carboniferous limestone, which skirts the coal-field nearly all round. A belt of this limestone crosses Glamorganshire south of the coal-field; and the old red sandstone is found at each extremity of the county, in the valley of the Romney, and in the peninsula of Gower, cropping out from beneath the carboniferous limestone. In the peninsula is a central ridge of old red sandstone, with two parallel limestone belts resting one on each side of the sandstone ridge. The same arrangement would probably be observed in the south eastern portion of the county, were it not that the ridge of sandstone and the more southerly belt of limestone are concealed by the more recent horizontal deposits of the lias, newer red marl, and conglomerate limestone, enumerated in the first part of this notice.

Coal-pits are numerous, especially in the valleys of the Tawe and the Neath; about the head of the Taafe and its tributary the Cynon, near Merthyr and Aberdare; and along the southern limit of the coal field near Bridgend, Llantrissent, and Caerphilly. In the lower part of the valleys of the Tawe and Neath, and along the southern limits of the coal-field, the coal is principally of a bituminous or binding quality; the pits round Merthyr and Aberdare yield 'coaking or iron-making coal;' and those in the upper valleys of the Tawe and Neath yield 'stone-coal,' which gives out little smoke, and is used, the large coal for malting, and the small coal, or culm, for burning lime.

Ironstone is found in the valley of the Neath, but most abundantly in Aberdare and near Merthyr, which last may be considered the capital of the iron district of South Wal . There are some lead mines in the district occupied by the carboniferous limestone, near Cowbridge and Llantrissent. Limestone is quarried in various places. (Greenough's *Geolog. Map.*)

Divisions, Towns, &c.—The county of Glamorgan derives its name from Morgan, a chieftain, said to be a descendant of Caradoc ap Brân, the Caractacus of the Roman historians, who possessed this territory (previously comprehended in a large district called Essyllwg or Gwent) after the departure of the Romans. Its designation was Morganwg (Morgan's country), or Gwlad Morgan, whence by corruption Glamorgan. This designation extended at first to Monmouthshire (which was included in the territories of Morgan), but as the princes who held the district in after-times were gradually dispossessed of their territories by the invasions of the Anglo-Saxons and Anglo-Normans, the limits of Morganwg were contracted. Till of late years (and perhaps even now) that part of Monmouthshire which is west of the Usk was popularly considered by the inhabitants of the eastern part to be in Morganwg. Down to the time of Henry VIII., when the present boundaries of the Welsh counties were fixed, the name Morganwg was given to the country between the Usk and the Neath, or perhaps the Tawe. The district so bounded was divided into six cantrevs, and subdivided into twenty-two cwmwds, as follows:—I. Cantrev GORVYNYDD: 6 Cwmwds, viz. Rhwng Nedd a Thawy; Tir yr Hwndrwd; Rhwng Nedd ac Avyn; Y Coetty; Tir yr Yarl; Maenawr Glynogwr. II. Cantrev PENYCHEN: 4 Cwmwds, viz. Meisgyn; Glyn Rhoddni; Tal y Van; Rhuthyn. III. Cantrev BREINIAWL: 2 Cwmwds, viz. Is Caeth; Uch Caeth. IV. Cantrev GWAUNLLWG: 6 Cwmwds, viz. Cibwr; Yr Haidd; Y dref Bervedd; Edelygion; Eithav; Y Mynydd. V. Cantrev ISCOED GWENT: 2 Cwmwds, viz. Iscoed; Lle Mynydd. VI. Cantrev GWENT UCH COED: 2 Cwmwds, viz. Trev Grug; Uch Coed. The peninsula of Gower, and probably all that part of the county which is west of the Tawe, belonged at that time to Caermarthenshire.

The modern divisions are as follows:—

Hundred.	Situation.	Population.
Caerphilly, or Caerphili	E.	29,577
Cowbridge	S. and Central	5,942
Dinas Powis	S. and S.E.	5,621
Kibbor, or Cibwr, including Cardiff	S.E.	8,796
Llangevelach, or Llangyfelach	N.W.	13,225
Miskin	Central and N.	10,855
Neath	Central and N.	13,090
Newcastle	S.W.	11,130
Ogmore	Central and S.	3,982
Swansea, including borough of Swansea (except hamlet of St. Thomas in the hundred of Llangevelach)	W.	23,965

The population of these hundreds, with the militia under training (429), makes the total population of 126,612.

Glamorganshire contains one city, Llandaff; three principal parliamentary boroughs, Cardiff, Swansea [SWANSEA], and Merthyr Tydvil [MERTHYR TYDVIL]; (the last two received the franchise, as principal boroughs, by the Reform Act; Swansea was previously a contributory borough to Cardiff:) seven contributory boroughs, viz. Cowbridge and Llantrissent, contributary to Cardiff; Loughor, Neath, Aberavon, and Kenvig, or Kenfig, to Swansea; and Aberdare to Merthyr: of these Aberdare was enfranchised by the Reform Act; the others were all previously contributory to Cardiff. Loughor, Aberavon, Kenvig, and Aberdare are not market-towns. Besides the boroughs are the market-towns of Bridgend and Caerphilly.

Cardiff, the capital of the county, is in the hundred of Kibbor, on the east bank of the river Taafe or Taff, or Tâf, about a mile above the entrance of the river into Pennarth Harbour. It is 166 miles from the General Post-office, London, by Calne, Chippenham, Bristol, and Chepstow. It is known to the Welsh by the name Caerdydd. Cardiff seems to be a corruption of Caer Tâf, the fortress on the Tâf; Caerdydd is thought to be derived from Caer Didi, the fortress of Didius, from a post which it is assumed the Roman general Aulus Didius erected here. The town consists of the principal street on the road from London to Pembroke, running east and west, a second main street at right angles to this, and several others. The town has nearly tripled in population within the last quarter of a century; the streets are regular, well paved, and lighted with gas; the houses are good, and many of them adapted to the residence of opulent families, especially in the suburb of Crockerton. The church of St. John is spacious and handsome, in the early English style of architecture, with a lofty, square, embattled tower in a later and more ornate style. The castle, now in possession of the Marquis of Bute, though greatly altered in order to its conversion into a modern mansion, is an interesting building. This castle was erected by Robert

Fitzhamon, the Anglo-Norman conqueror of Glamorganshire, in the room of a smaller which stood on the same site, built by the Welsh princes of Morganwg. The unfortunate Robert, duke of Normandie, brother of William Rufus and Henry I., died in the castle, having been a prisoner for twenty-eight years. The west front of the castle (which is modern), flanked by a massive octagonal tower, appears to great advantage on entering the town from the west. The ruins of the antient keep, on a circular mound, still standing within the castle enclosure, command an extensive prospect over the level amid which Cardiff is situated. The moat by which the keep was surrounded has been filled up, the acclivities of the ramparts planted, and a gravel walk, open to the public as a promenade, carried round the whole enclosure. The tower in which Duke Robert is said to have been confined is yet standing. In the interior of the castle are some family portraits and other paintings by Vandyke, Kneller, Romney, and other artists. There is at Cardiff a stone bridge over the Taafe, of three large and two smaller arches. The theatre is a neat building with a Grecian portico. There is a county gaol recently erected in the room of a former one built according to the plan of Mr. Howard, but which had become too small. The new gaol is in the suburb of Crockerton; it is calculated to hold eighty prisoners; it comprehends the house of correction for the eastern part of the county. The guildhall, a respectable modern building, stands in the midst of one of the principal thoroughfares. The assizes are held in it.

The population of Cardiff, which at the commencement of the present century was under 2000, amounted in 1831 to 6187. A considerable proportion consists of poor persons who have, through the depression of agriculture, forsaken the neighbouring villages, and live in houses of the lowest description, built by speculators for their accommodation. The only manufacture carried on in the town is of iron, and this but to a small extent. The prosperity of the place depends much upon its trade as the port of Merthyr and the iron district up the valley of the Taafe. It communicates with Merthyr by a canal already noticed. The trade of the town has been on the increase for some years past. The number of vessels that entered the port was, in 1829, 1922, with 131,977 aggregate tonnage; the number of ships that entered the port in 1832 was 2482, with 183,480 aggregate tonnage. The markets are on Wednesday and Saturday; the former is small; the Saturday market is abundantly supplied with corn, provisions, and various articles of merchandise. There are three yearly fairs, all for cattle, and well attended. The county assizes and the Epiphany quarter-sessions are held here.

Cardiff is a corporate town of antient date. The earliest charter possessed by the corporation is dated 12 Edward III. (A.D. 1338); but the governing charters were of 42 Elizabeth (A.D. 1600) and 6 James I. (A.D. 1608). By the Municipal Reform Act the corporation consists of six aldermen and eighteen councillors. The town was by the same Act divided into two wards. The boundaries of the parliamentary and municipal boroughs are coincident. The town, with its contributory boroughs, sent one member to parliament by the statute 27 Henry VIII. The right of election was in the burgesses at large, to whom the Reform Act has added the 10*l.* householders; but the separation of some of the contributory boroughs to form the Swansea district has rather diminished the constituency. Before the Reform Act it was estimated at 1000; by the registry of 1832 there were in Cardiff, Cowbridge, and Llantrissent, burgesses, 454; 10*l.* householders, 233: total, 687.

The town consists of two parishes, St. John's and St. Mary's; but these are, for ecclesistical purposes, united: St. Mary's church stood near the river, at the south-west extremity of the town, and was carried away by a great flood A.D. 1607. The conjoint livings constitute a vicarage, of the yearly value of 260*l.*, with a glebe-house, in the gift of the dean and chapter of Gloucester. There are meeting-houses for English and Welsh Baptists, Presbyterians, Independents, and Wesleyan Methodists.

By the returns of 1833 there were, one infant-school, with 83 children; two day-schools, supported by subscription, with 164 children (for one of these, a national school, large school-rooms have been erected at a considerable expense); eight day or boarding and day schools, with 253 scholars; and two Sunday-schools, with 521 scholars: to the Sunday-schools lending-libraries are attached. There are several charities in the town.

The Marquis of Bute has obtained an Act for forming a new line of street, a new harbour, new wharfs, and almost a new town on the east side of the river, and the excavations are already far advanced.

Llandaff (Llan Tâf, the church of the Tâf), in the hundred of Kibbor, though of episcopal rank, is now only a village, on the west bank of the Taafe, about two miles from Cardiff. The parish is large (containing 2386 acres) and straggling, divided into five hamlets, and comprehending three villages (Ely, Canton, and Fairwater) beside Llandaff. This is a poor place; it contains two mansions, and one or two neat and respectable small dwelling-houses. The principal building is the cathedral, which was antiently more extensive than at present; the limits of the edifice having been contracted in the repairs of 1751, by building a new western front across the nave, the western portion of which was abandoned to decay. This western portion of the nave is a fine specimen of early English architecture, with an enriched Norman door on the south side, and a plainer door (also Norman) on the north side. The original west front has a series of delicately executed lancet windows, of various sizes, and has at its northern angle a fine tower in the perpendicular style: two sides of this tower rest on the walls of the church, the other two are raised on two light arches which spring from a single pillar within the nave. The pinnacles of this tower were damaged and a corresponding tower at the southern angle of the west front was thrown down by a great storm in the year 1703. The present cathedral comprehends the transepts, the choir, and part of the nave of the former building: the new west front, with singular incongruity, is of Grecian architecture; even the altar was enclosed with a Grecian portico, but this deformity has been removed. The entire length of the body of the church is 300 feet, the breadth 80 feet. At the eastern end of the choir is the lady chapel, which, with part of the choir, is of decorated English architecture. In this chapel divine service is sometimes performed in Welsh. The chapter-house, on the south side of the church, is a square building with a central pillar, from which spring the arches that support the roof; it is in the decorated English style, with plain but elegant groining; it is now disused. Many persons of eminence have been buried at Llandaff, but the monuments in the cathedral are mostly dilapidated, and have been removed from their original positions. Near the cathedral are the ruins of the episcopal palace, consisting of a large gateway and part of the external wall. The destruction of this building, together with that of the principal portion of the church, is attributed to Owen Glendwr.

The population of the whole parish in 1831 was only 1299. There are yearly two considerable cattle fairs at Llandaff. The cathedral is used as the parish church; and the service is the usual parochial (not cathedral) service. The duty is performed alternately by two priests-vicars. The chapter of the cathedral receive the great tithes of the parish of Llandaff, and of the adjoining parish of Whitchurch united with it. The priests-vicars receive a stipend in lieu of the small tithes. Of the diocese of Llandaff we shall speak below.

There are two national schools, with 118 children, besides any others who like to attend on Sundays.

Cowbridge is in the hundred of Cowbridge, on the little river Daw, or Thaw, on the road between Cardiff and Swansea, 12 miles from Cardiff, and 178 from London. It is a neat cheerful town, consisting mainly of one wide street. Cowbridge was antiently walled, and had three gates, one at each end of the main street, and another, yet standing, on the south side of the town. The old town-hall and market-house, which were in the centre of the main street, have been lately removed. The borough limits comprehend little more than 33 acres; the borough forms a chapelry to the parish of Llanblethian. The population of the borough in 1831 was 1097; of the rest of the parish 670. Of the population of the borough scarcely any part is agricultural; there is little trade, and the place maintains its standing chiefly by means of one or two schools of good repute. The market is on Tuesday, but there is also one on Saturday for butcher's meat and provisions; and there are five yearly fairs.

The corporation is antient, though the governing charter is of 33 Charles II. The vicarage of Llanblethian, with its

annexed chapelries of Cowbridge and Welsh St. Donatt's, is of the clear yearly value of 279*l.*, in the gift of the dean and chapter of Gloucester. The chapel of Cowbridge is an antient structure and of considerable size. There are places of worship in Cowbridge for Calvinistic and Wesleyan Methodists and Baptists.

Cowbridge is a contributory borough to Cardiff. The number of voters on the register in 1832 was 105, viz. 50 freemen and 55 ten-pound householders. There were, in 1833, one endowed grammar-school of considerable repute, with 30 scholars; five other schools, with 213 to 233 scholars; and four Sunday-schools, with 215 scholars.

Llantrissent is in the hundred of Miskin, and occupies a commanding situation on the brow of a lofty hill which overlooks some of the finest parts of the vale of Glamorgan, the Bristol Channel, and the hills of Devonshire. It is not far from the east bank of the Ely, and in a position very central to the towns of Cardiff, Cowbridge, Bridgend, and Merthyr. The borough limits comprehend the town and a considerable portion of the country all round. the parish, which is divided into five hamlets, is much more extensive, being 10 miles long from north to south, and varying in breadth from 1½ mile to 5 miles. The town contains little worthy of notice. The church is an antient and capacious building, in the Norman style, and being dedicated to three saints, gave name to the town (Llan-tris-saint). There are meeting-houses for Baptists, Independents, Calvinistic and Wesleyan Methodists. The town-hall and market-house are of modern erection. There are some remains of an antient castle. The population of the parish in 1831 was 2789; about one-third was agricultural, and nearly a fourth was engaged in the collieries which are wrought in different parts of the parish. The market is on Friday, for provisions; there are three yearly fairs. The corporation is antient, but the charter, if it is yet existing, is disregarded in practice. The borough is contributory to Cardiff. The register for 1832 contained 202 freemen and 9 ten-pound householders. The living is a vicarage of the yearly value of 555*l.*, with a glebe-house, in the gift of the dean and chapter of Gloucester. There are two perpetual curacies in the parish, both endowed, viz. St. John Baptist, the chapel of which is near the head of the Ely, and Tal-y-garn, of which the chapel is between Llantrissent and Cowbridge. There were in the parish, in 1833, five day-schools, with 162 children; two national schools, with 119 children; and five Sunday-schools, with 310 children.

Loughor (in Welsh, Cas Llwchwr) is in the hundred of Swansea, at the mouth of the river Loughor, on the left or south-east bank of the river, about seven miles west-north-west of Swansea. The borough comprehends an area of 1000 acres, extending round the town on the land side; the rest of the parish contains about 2000 acres. The village consists of one main street, having the church at the western end of it, on a point jutting into the river. The village contains some genteel residences; and an Act has been obtained for building a bridge over the Loughor at this place, and it is thought that the mail-road from Swansea to Caermarthen will be brought through it. The bridge was building in 1833, and it is doubtless now finished. The population of the borough in 1831 was only 665. Several hands are employed in a colliery and copper-works within the borough. There is the shell of an old castle at Loughor, and east of the town are two small Roman camps. Loughor has been considered by many to be the Leucarum of the Romans, which, from the Roman antiquities discovered here, and from the name, seems sufficiently probable.

The corporation has no charter. The borough was formerly contributory to Cardiff; it is now to Swansea: the number of voters on the register for 1832 was 177, viz. 146 freemen, and 31 ten-pound householders.

The living is a rectory, in the diocese of St. David's and archdeaconry of Caermarthen, of the clear yearly value of 149*l.*, with a glebe-house, in the gift of the lord chancellor. There were, in 1833, one national school, with 44 children, and two Sunday-schools, with about 80 children.

Neath is in the hundred of Neath, and on the Pembroke mail-road, between Cowbridge and Swansea. It is 8½ miles from Swansea, 25 from Cowbridge, 37 from Cardiff, and 203 from London. It is pleasantly situated near the left or east bank of the river Neath, about 2½ miles above its mouth. The Neath Canal passes between the river and the town, close to the latter. The boundaries of the parish and borough comprehend a considerable space round the town. The town consists of a number of streets, lighted and paved, and contains many good houses, inhabited by opulent families, merchants, and substantial tradesmen. The town-hall, with the market-house beneath, stands in the middle of the market-place. The church is of good size, and has a square embattled tower at one end. It is supposed to have been originally the garrison chapel to the castle, of which part of the walls and a gateway, flanked by two towers, are yet standing: this castle is supposed to have been founded by one of the Norman chieftains who conquered Glamorganshire: a few good houses have been built on the right bank of the river, over which there is a bridge.

The population in 1831 was 4043. The trade of the place is considerable. The river is navigable up to the bridge for vessels of 300 to 400 tons; but Britton Ferry, near the mouth of the river, is generally used as the port, and the communication with the town is by barges. The exports are coal, culm, copper, iron, spelter, fire-bricks, oak timber, and bark; the imports are copper and iron ore, corn, flour, foreign timber, &c. There are large copper and iron works on the right bank of the river. The markets are on Wednesday and Saturday: that on Wednesday is the chief; and there are three fairs in the year. Neath is a borough by prescription, and has now no governing charter. By the Municipal Reform Act there are 4 aldermen and 12 councillors. Neath was formerly a contributory borough to Cardiff: by the Parliamentary Reform Act it was made contributory to Swansea. The number of voters on the register in 1832 was 179, viz. 42 freemen and 137 ten-pound householders. The living of Neath is a rectory, with the chapelry of Lantwit annexed, of the clear yearly value of 353*l.*, with a glebe-house. There are many dissenting meeting-houses. There were, in 1833, two infant-schools, with 158 children; wo national schools, with 220 children; seven day or boarding and day-schools, with 179 children; and two Sunday-schools, with 200 children.

About a mile from Neath are the ruins of Neath Abbey, ounded and endowed by Richard de Grenville in th welfth century, and occupied successively by Franciscan and Cistertian friars. At the Dissolution the yearly revenue of he abbey was valued at 150*l.* 4*s.* 9*d.* gross, and 132*l.* 7*s.* 7*d.* lear. The ruins stand in the low grounds bordering on he river Neath. A considerable part of the priory-house s yet standing, but the abbey church is a heap of ruins. A long room, probably the chapter-house, with a double-aulted ceiling supported by diagonal arches which rise from the side walls and from a row of central columns, is yet standing, and foundations of buildings are traceable to a considerable distance.

Aberavon is in the hundred of Neath, 6 or 7 miles east of the town of Neath. It is a small place on the right bank of the river Avon, about two miles above its mouth. The town, or rather village, consists of a few indifferent houses. The church is small and of modern erection, and there are three dissenting meeting-houses. There is a stone bridge of one arch over the river. The population in 1831 was 573; but it is probably considerably higher now, the increase in the ten years before 1831 having been very large, owing to the iron-works established near the town, though not within the parish. The mouth of the river forms a small harbour. The town is a borough by prescription. Aberavon was formerly a contributory borough to Cardiff; now to Swansea. The parliamentary boundaries are much wider than those of the municipal borough and parish, and include a larger population. There were on the register, in 1832, 86 voters, viz. 52 freemen and 34 ten-pound householders. The living is a vicarage, with the chapelry of Baglan attached, of the clear yearly value of 154*l.*

There were, in 1833, one day-school, with 20 children, and two Sunday-schools, with 104 children.

Kenfig, or Kenvig, is a straggling village on the edge of the sand-hills which border the eastern side of Swansea Bay, 15 miles from Neath, and 2 miles from the Milford and Pembroke mail-road. The borough boundaries, parliamentary and municipal, comprehend the parish of Lower Kenfig and the hamlet of Higher Kenfig, which is in Margam parish. There are a small church and a town-hall of modern date, and near the town the remains of an antient castle. Kenfig was once of more importance: its downfal dates from a tremendous inundation in the sixteenth century. Kenfig Pool, about a mile and a half round, is between the village and the sea. The population of Lower Kenfig parish in 1831 was 276; of the whole borough 485, chiefly

agricultural. The corporation is very antient: of three charters now in existence (neither of which is however regarded in practice), the oldest is of 9 Henry I. The borough was formerly contributory to Cardiff, it is now to Swansea: the number of electors on the register in 1832 was 177, all freemen. The living of Lower Kenfig is a curacy, united with the vicarage of Pyle; their joint annual value is 95*l.*, and they are in the gift of the lord chancellor. There was in the parish, in 1833, one infant-school, with 16 children.

Aberdare is in the hundred of Miskin, in the north-east part of the county. The parish is very extensive and is divided into four hamlets. The town or village of Aberdare is in the centre of the parish, on the right bank of the Cynon, about three miles from Merthyr Tydvil. The church is a simple rustic edifice without a tower, and there are several dissenting meeting-houses. The importance of Aberdare has arisen from the increase of the iron-works: the population, by the census of 1811, was 1338; in 1831 it was 3961. There is no regular market, but there are three yearly fairs. The Aberdare Canal terminates within a mile of the town; it communicates with the Glamorganshire Canal. Aberdare was enfranchised by the Reform Bill, and the parliamentary boundaries include the whole parish: it is contributory to Merthyr Tydvil, or rather forms a part of that borough, to which it is adjacent.

The living is a perpetual curacy, of the yearly value of 108*l.*, in the gift of the vicar of Llantrissent. There were, in 1833, one endowed day-school, with 22 children; five other day-schools, with 171 children; and five Sunday-schools, containing about 600 children.

Bridgend is in the hundred of Newcastle, and in the parishes of Newcastle and Coyty, about 7 miles west of Cowbridge. A new line of road carries the Pembroke mail through it. It is divided into two parts, Oldcastle on the left, and Newcastle on the right bank of the Ogmore, over which are two stone bridges. It is well built, with many good houses, and in a pleasant neighbourhood. The two divisions of the town take their name from two fortresses, of different dates, the Old Castle and the New Castle. Of the latter there are some remains. There is a chapel-of-ease to Coyty in Oldcastle, and in Newcastle is the church of the parish of Newcastle. The population of the two parishes in 1831 was 2532, about one-third agricultural. There is a considerable market for corn and provisions on Saturday, and two yearly fairs, chiefly for the sale of cattle and cheese. Stone is quarried in the neighbourhood. The member for the county was formerly elected at Bridgend, but Cardiff is now the chief place of county election.

The living of Coyty, or Coity, is a rectory, with the chapelry of Nolton annexed, of the clear yearly value of 416*l.*: that of Newcastle is a vicarage, with the annexed chapelries of Bettws, Laleston, and Tythegston, of the clear yearly value of 197*l.*, with a glebe-house, in the gift of the lord chancellor.

There were in the two parishes, in 1833, one infant-school, with 53 scholars: one national school, with 254 scholars; eight day-schools, with 133 scholars; and five Sunday-schools, with from 420 to 460 scholars.

Caerphilly, in Caerphilly Hundred, near the river Romney, which forms the eastern boundary of the county, is a small straggling place, but consists for the most part of well-built houses. The most striking object in the town is the antient castle, the ruins of which are superior to most in the kingdom. They occupy a moderate elevation near the middle of a level tract; and consist of walls and towers with various apartments. Of the great hall of the castle, a magnificent apartment 70 feet long by 30 wide and 17 high, there are considerable remains: there is in it an ornamented fire-place with two ogee-headed windows on each side. But the most remarkable feature of the castle is the leaning tower, a vast fragment of a tower which has been thrown considerably out of the perpendicular without falling. The origin of the castle is not clearly ascertained. In the civil dissensions of the reign of Edward II., it was seized by the king's minion, the younger Despencer, who was besieged here by the troops of Mortimer, to whom the castle had belonged, aided by succours from the Queen Isabella of France. After a long siege the castle was taken, partly by storm and partly by capitulation.

The population of Caerphilly is small. It is in the parish of Eglwsilan, which contains altogether 2818 or 2820 inhabitants: but of these the hamlet of Ener-Glynn, which comprehends the town, contains only 884. There are some woollen manufactures. The market is on Thursday, and there are six yearly fairs.

The living of Eglwsilan is a vicarage united with that of Llanilan Vabon, of the clear yearly value of 140*l.*, with a glebe-house, in the gift of the Chapter of Llandaff. There is at Caerphilly a chapel dedicated to St. Martin, lately rebuilt. To this there is a perpetual curacy attached, of the clear yearly value of 120*l.*, in the gift of the Chapter of Llandaff. There are several places of worship for dissenters in the parish.

There were in the parish of Eglwsilan, in 1833, two endowed day-schools, with 93 girls; five other day-schools, with 160 children; and three Sunday-schools, with 253 scholars.

Divisions for Ecclesiastical and Legal purposes.—We have no official statement of the number of benefices in the county: the population returns for 1831 enumerate 128 parishes or parochial chapelries, besides which there are several district chapelries. The parishes are for the most part in the diocese and archdeaconry of Llandaff, but 22 of those in the western and north-western parts of the county are in the deanery of Gower, the archdeaconry of Caermarthen, and the diocese of St. David's. The 128 parishes or chapelries (of which three, viz. Bedwas, Machen, and Michaelstone Fedw, are partly in Monmouthshire) are thus classified according to the nature of the benefice: 56 rectories, 39 vicarages, 23 perpetual curacies, nine chapelries, and one donative. The benefices are commonly small. Of one our authorities do not give the value, and 24 are permanently annexed to other benefices: of the remaining 103, 32 are under 100*l.* clear yearly value; 39 between 100*l.* and 200*l.*; 16 between 200*l.* and 300*l.*; 7 between 300*l.* and 400*l.*; 6 between 400*l.* and 500*l.*: and 3 upwards of 500*l.*

The origin and early history of the see of Llandaff are involved in considerable obscurity. The first bishop is supposed to have been St. Dubritius, who is said to have been consecrated about the beginning of the sixth century by St. Germanus and St. Lupus, bishops of Auxerre and Troyes in France, who had come over to Britain in order to check the doctrines of Pelagius. About ninety bishops have successively occupied this see, from its commencement to the present time.

The diocese of Llandaff includes all Glamorganshire with the exceptions above-mentioned; and all Monmouthshire, except seven parishes, of which four are in the diocese of Hereford and three in that of St. David's. It contains only one archdeaconry, that of Llandaff. At an early period there were two archdeaconries, Monmouth and Glamorgan. The bishopric is the poorest in the Anglican Church; the net yearly revenue having been reported to the Ecclesiastical Commissioners as only 924*l.* including the preferments. The treasurership of the cathedral is commonly annexed to the bishopric; and the deanery of St. Paul's, London, and the rectory of Bedwas, are commonly held in commendam. This patronage is comparatively very small. The Chapter of the cathedral consists of 13 persons.

The county is included in the South Wales circuit. The assizes are held at Cardiff; also the Epiphany quarter-sessions: the other quarter sessions are held, the Easter at Cowbridge, the Midsummer at Neath, and the Michaelmas at Swansea. The county gaol is at Cardiff, and there are houses of correction at Cardiff and Swansea.

Five members of parliament have, since the passing of the Reform Act, been returned from Glamorganshire, viz., two for the county, and one for each of the three districts of boroughs. The place of election for the county is Cardiff; and the polling stations are Cardiff, Bridgend, Merthyr Tydvil, Neath, and Swansea. The borough members are elected at Cardiff, Swansea, and Merthyr Tydvil respectively. Before the Reform Bill only two members were sent, viz., one for the county, who was elected at Bridgend, and one for the Cardiff district of boroughs.

History, Antiquities, &c.—Glamorganshire was originally included in the territory of the Silures. [BRITANNIA.] Under the Roman dominion it was included in Britannia Secunda. A Roman road, the Julia Strata, traversed the county, in nearly its greatest extent, east and west; and several Roman stations are supposed to have been established within its boundaries. The river Taff was probably known under the two names of Rhatostathybius (Ῥατοσταθύβιος, Ptolemy), and Tibia (Richard of Cirencester). It has been supposed that there was a station on its banks; and the name of Cardiff (the first syllable of which, 'Caer,' is,

like our own terminations 'Chester' and 'Caster,' the frequent indication of a Roman post), has led some to fix upon it as the site of this station. No Roman remains have however been discovered at Cardiff; but there is a camp undoubtedly Roman at Caerau, three miles west of it, in good preservation: the parish church stands in its inclosure. A smaller camp, and some indications of Roman iron-works, have been discovered in the neighbourhood. The Bovium, or Bomium, of Antoninus has been fixed at Boverton, a village a few miles south of Cowbridge, and not far from the sea. Others fix the station at Ewenny, near Bridgend; induced by Roman remains discovered here: neither place accords, in respect of distance from Nidum, the next station, with the existing copies of Richard. The Nidum of Antoninus, situated on the river Nidus, may be safely identified with Neath on the river Nedd, or Neath; and the Leucarum of the same writer was probably Loughor. The distance of Neath and Loughor corresponds sufficiently with that given by Richard. Some vestiges of the Julia Strata still remain between Ewenny and Neath; and there are traces of two cross-roads, one from Cardiff and one from Neath, both leading to Bannium, now Caer Banna, near Brecon.

The twelfth 'Iter' or route of Antoninus, in which the names of the above stations occur, is remarkably perplexed, owing probably to the error of some transcriber who has confounded Moridunum (near Seaton) in Devonshire with Maridunum, now Caermarthen, and has united two separate routes, or fragments of routes, so as to form one, passing without notice from Devonshire into South Wales. He has also transposed Nidum and Bomium. These errors were not perceived by Horsley, who has consequently fixed Nidus (Nidum), Bomium and Leucarus (Leucarum), in Somersetshire. In Richard of Cirencester the perplexity is cleared up.

A road and some encampments are traceable in the northern part of the county, near the turnpike-road from Swansea to Llandilovawr [CAERMARTHENSHIRE]; but there seems no reason to ascribe to them a Roman origin.

A native prince gave to the district his own name, Morgan, whence the modern appellation. About the close of the eleventh century the county fell into the hands of the Anglo-Norman barons, for whose warlike activity their sovereigns gladly found exercise by encouraging their efforts for the conquest of Wales.

Rhys ab Tewdwr, king of Dinevor (Caermarthenshire), was at strife with Jestyn ab Gwrgan, prince of Glamorgan, whom he had expelled from Dinevor, which Jestyn had seized, and with Einon ab Collwyn, an insurgent noble of Dinevor, who had taken refuge with Jestyn. By the mediation of Einon, who had served under William the Conqueror in France, and had formed an intimacy with many Norman knights, Jestyn engaged the services of several Normans under Robert Fitzhamon, and by their aid totally defeated Rhys on Hirwain Wrgan, an extensive common on the border of Glamorgan and Brecknockshire, about two miles north of Aberdare village. Rhys was shortly afterwards slain; and Jestyn, thinking himself secure, dismissed the Normans, to whom he fulfilled his engagements, but refused to fulfil his promises to Einon, whom he moreover reproached as the betrayer of his country. Einon in revenge persuaded Fitzhamon to attempt the conquest of Glamorgan, which, from the disaffection of Jestyn's subjects, he accomplished with little difficulty.

The country thus became subject to Fitzhamon, who proceeded to parcel it out in lordships among the knights who had followed him, and, with wise though unusual policy, among the native chieftains who had assisted him, and even among the children of Jestyn, his rival. About this period arose the Norman castles, of which there are several remains. Fitzhamon himself was raised to the dignity of earl of Gloucester, and was in favour at the court of William Rufus.

Among the measures of Fitzhamon was the abrogation of the antient customs of the country, to make way for the feudal system, which he sought to introduce. The attempted change however led to a revolt: and while the Normans were engaged in the invasion of Gower, Fitzhamon was surprised in his castle at Cardiff (A.D. 1094), by the natives under the conduct of Payne Turberville of Coity, one of the most powerful of his Norman feudatories. Unprepared for resistance, Fitzhamon was obliged to consent to the restoration of the antient usages. Encouraged by this success, the Welsh attempted to expel the invaders, but the Anglo-Normans retained possession of the conquered districts, though they conceded to the natives some immunities from the requirements of the feudal system. Fitzhamon was a supporter of Henry I., and duke Robert of Normandie was, upon his capture, committed as a prisoner to his charge. Fitzhamon died A.D. 1107.

The district of Glamorgan passed, by his marriage with Mabel, heiress of Fitzhamon, into the hands of Robert earl of Gloucester, natural son of Henry I. He renewed the attempt to enforce the full rigour of the feudal system, but was baffled by the resistance of the people, who surprised and took him prisoner in Cardiff castle, which they stormed. He obtained his release upon giving his oath to respect the antient privileges of the natives.

Glamorganshire remained united with the other possessions of the earldom of Gloucester. In A.D. 1315 the natives revolted, and although the revolt was suppressed, it obtained for them the abolition of some feudal usages which had been introduced. In the troubled reign of Edward II. considerable lands in Glamorganshire were granted to his favourite the younger Despencer; and the county became the scene of violence and confusion, the barons confederated against the court ravaging these lands, and at length driving Despencer into banishment, A.D. 1321. On the return of the Despencers from banishment, the younger not only obtained the restoration of his Glamorganshire estates, but their augmentation by new grants. In the subsequent revolt of the barons, A.D. 1327, the king and his favourite, after the capture of Bristol and the execution of the elder Despencer, took refuge in Neath Abbey, from whence Despencer escaped to Caerphilly Castle. When this was taken he again escaped, but both the king and he were soon after captured near Llantrissent. Despencer was forthwith executed at Hereford, and the king was sent to Berkeley Castle, where he was murdered. The heirs of Despencer obtained however the restoration of his Glamorganshire estates, and had the title of lords of Glamorgan. These estates came by marriage to the earl of Warwick, the 'king-maker,' in the reign of Henry VI. and Edward IV., and afterwards, also by marriage, to the duke of Gloucester, afterwards Richard III. In the reign of Henry VIII. an end was put to the authority of the lords marchers, which these nobles had held, and the territory of Glamorgan was formed into a county; and the manors of the former lords of Glamorgan passed into other hands, as well as the subordinate lordships.

Of the middle ages Glamorganshire contains many memorials in its ruined castles and monastic remains. Besides the castles of Cardiff, Caerphilly, Neath, and Swansea, there are several others. Coity Castle is about two miles north-east of Bridgend: the ruins are among the most extensive of any in South Wales, being second only to Caerphilly. It was the seat of the Turbervilles, and was built by Payne de Turberville, mentioned above as the leader of a revolt against Fitzhamon. Of the castles of Llanblethian and Talavan, near Cowbridge; of Morlais, near Merthyr Tydvil; of Penarth and Penrice, in the peninsula of Gower, west of Swansea, there are small remains. The ruins of Ogmore castle, near the junction of the Ewenny and the Ogmore, are more considerable. Oystermouth castle, a bold and majestic ruin, stands on the shore of Swansea Bay, south-west of Swansea; the grand gateway is still nearly perfect, and other parts of the building are in good preservation. The remains of St. Donatt's castle, near Nash Point, on the coast, are considerable and in better preservation than most of the castellated ruins of Glamorganshire. Part of it is inhabited: it is principally in the perpendicular English style. Of Marcross castle, near St. Donatt's, the remains are unimportant. Oxwich castle and Bewper castle are castellated mansions of the sixteenth century; the remains of both are or were lately occupied as farm-houses: the first is on Oxwich Bay: the second, near the Daw, or Thaw, south of Cowbridge. Penmark and Fonmon castles are near the Daw: the first is in ruins; the second, repaired and modernized, is the mansion of the Jones family, descendants of Col. Jones, one of the Judges of Charles I.

Of the ecclesiastical remains the most conspicuous is Margam Abbey, between the Ogmore and the Avon, south-east of Neath. It is not certain by whom it was founded. Tanner (*Notitia Monastica*) and Dugdale ascribe it to Robert earl of Gloucester, natural son to king Henry I., and date its foundation A.D. 1147. It was for Cistertian monks:

any other religious denomination; such exclusions being disclaimed in almost every instance, especially in schools established by dissenters, with whom are here included Wesleyan Methodists.

Lending-libraries of books are attached to five schools in this county.

GLAND. Under this term are included a considerable number of organs in the animal body, which, resembling each other only in a general roundness of form and a firm fleshy substance, possess the most varied internal structure, and perform very different functions. They may be divided into three classes.

1. *Absorbent Glands.*—These form part of the absorbent system. [ABSORBENTS.] They are masses of various size, of a roundish form, consisting of a congeries of ramified absorbent vessels, frequently communicating with each other, connected by fine dense cellular tissue in which blood-vessels are freely distributed, and at intervals dilated so as to give an appearance, when divided, as if a collection of small cells had been cut into. Their precise use is unknown. They occur in considerable number in the course of the absorbents in man and mammalia, are far less numerous in birds, and are entirely wanting in fish and amphibia, being replaced by simple plexuses of absorbents, which are not collected into solid masses.

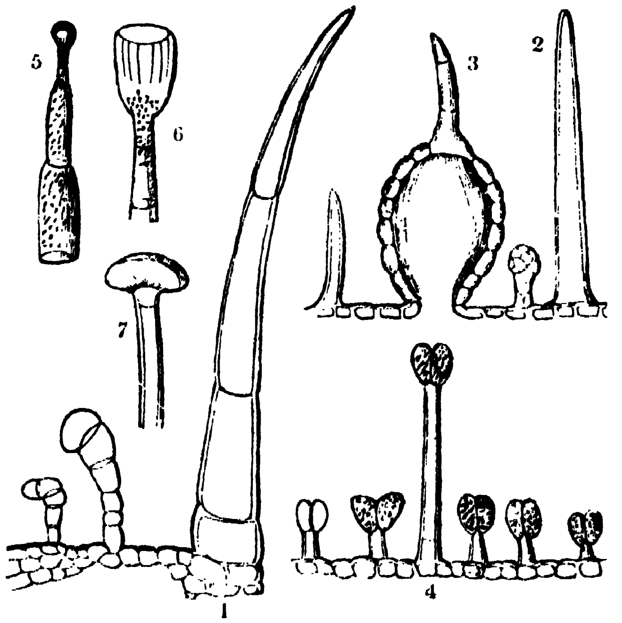
2. *Secernent Glands.*—These are organs of various forms and sizes, whose office it is to separate the various secretory and excretory fluids from the blood. The simplest form of secernent gland is that called a crypt, consisting merely of a pit or depression in the surface of some secreting membrane, as the mucous lining of the intestines or the skin. When this depression is deeper, and assumes a cylindrical form, it is called a tubule; and when its closed extremity is dilated so as to give it the form of a flask, a follicle. In various forms and sizes these simple structures are found in great numbers in all animals, as in the sebaceous follicles by which the oily matter is secreted to lubricate the skin, in the gastric glands, &c. In larger size they occur around the pylorus of many fish, forming worm-shaped appendages, and in different parts of the intestines of insects. Sometimes a number of little follicles are congregated together into one mass, opening on the surface each by a separate orifice, or by one common duct, around which they are arranged: the former structure is found in the tonsils, &c.; the latter in the Meibomian glands in the eye-lids.

Far more complicated forms are produced when each duct divides into numerous ramifications, each of which terminates in a cul-de-sac, or bears little follicles at its extremity and along its branches. Each of these more compound glands may be formed of the ramifications of a single secreting duct, with its accompanying vessels and nerves, or of a congeries of ramified ducts, each opening by a separate orifice: the former occurs in the kidney and liver, the latter in the mammary and prostate gland, &c. The structure of each gland however must be referred to the separate description of each: but the general laws governing their most varied conformation may be here stated:—they all consist of simple or ramified ducts, communicating at one extremity by open orifices with the external air, directly on the surface of the skin, or indirectly on the surface of one of the open cavities of the body, as the lungs, intestines, &c., and terminated at the other by a blind pouch, or cul-de-sac. On the walls of these ducts, arteries, veins, and absorbents ramify, forming minute capillary net-works in immediate contact with their lining membrane, through which secretion takes place probably by transudation, as no direct communications can be discovered between the ducts and any other vessels. A general end served by this structure is the obtaining a large secreting surface in the smallest space; the lining membrane of the ducts of one gland, whose external surface does not measure more than three inches, would, if it could be spread out, present a surface of more than three square feet.

The development of each of the more compound glands in the embryo presents an epitome of the general series of forms which the class presents: each is at first seen as a mere depression in the mucous membrane; then it elongates and appears as a tubule or follicle; then ramifies, and continues dividing and subdividing till it attains its perfect form, efflorescing, as it were, on the original secreting surface. The blood-vessels send off twigs which accompany each branch to its minutest divisions, connecting them all together, and, with the fibrous envelope which covers every gland, forming the separate ducts into one solid mass.

3. *Vascular Glands.*—These are masses consisting of a congeries of arteries and veins, but without any duct opening externally. Their office is quite unknown, and their minute structure uncertain. They include the placenta, renal capsules, spleen, and the thymus and thyroid glands.

GLAND, in Botany, is any superficial callosity, whether of a secreting nature or not. Glands are in all cases formed of cellular tissue, and are very analogous to hairs, from which they differ principally in their more compound structure, and in having their tissue always filled with secretion of some kind. They occur in abundance on the stems and leaves of many plants, and are also met with on the calyx, corolla, stamens, and some ovaries. Their most common form is that of a small round tubercle, either seated close upon the surface, as on the petioles of a peach-tree, at the base of the leaves of many Euphorbiaceous plants, or on the apex of the filament of some Rutaceæ, or else elevated on the end of a common hair; sometimes they are sessile, with a hair growing from them, as in the common nettle. In general glands are solid; sometimes they are cup-shaped, and filled with a secretion which gradually drops from them. Among the most unusual forms are the round depressed glands which cover the upper surface of the leaves of Dionæa, and close up the apertures of the stomates and the hard kernel-like glands in the pitcher of Nepenthes, lying below the cuticle, which is pierced above them. These organs evidently are adapted to purposes of secretion, and have lately been the special subject of a learned treatise by Professor Meyer of Berlin, from which the following sketches are borrowed.



1, common hairs of the stem of Bryonia alba, becoming glandular at the base or apex; 2, 3, a mixture of hairs (2) and glands (3) from the stem of Dictamnus; 4, double glands at the point of the hairs of Lysimachia vulgaris; 5, a hair glandular at the apex, from Primula Sinensis; 6, gland on the end of the hairs of Sisymbrium Sophia; 7, one of the yellow glands found on the head of the hairs of Scrophularia nodosa.

Lenticular glands are very improperly so called, as they do not appear to have any function connected with secretion. They are the small tubercles peeping through the cuticle of the stem of the common willow and other similar plants, and appear to be in reality nothing more than the rudiments of roots, unable to develop in the dry air that surrounds the stem.

GLANDULI'NA. [FORAMINIFERA, vol. x., p. 347.]

GLANVILE, a name by which one of the most antient treatises on the laws and customs of the realm of England is known. It classes with Britton, Bracton, and Fleta, the antient text-writers of the law, and is believed to be more antient than they. It is generally supposed to be the work of Ranulf de Glanvile, who was the chief justiciary in the reign of king Henry II.; but the titles to some of the best manuscripts only set forth that it was written in his time. Earlier than his time it cannot be, for among the exemplifications of law processes are some which took place in court before this Ranulf.

The study of this writer is necessary to those who would obtain a critical knowledge of the state of the English constitution in the first century after the Conquest, before the constitution underwent the modification which the granting of the Great Charter by king John occasioned; and the facilities for studying it are much increased by the publication in 1812 of a translation by J. Beames, Esq. There is room for an edition of the original, improved by the collation of the best manuscripts which exist of it, one of which is to be found in the library of the Honourable Society of Lincoln's Inn.

GLAREA'NUS, HENRI'CUS LORITUS, a most learned writer on music, was born at Glaris in Switzerland, in 1488. He studied under Erasmus, with whom he lived in the strictest intimacy; and his master for music was Johannes Cochlæus, author of *Tetrachordum Musicæ*, a work in 4to., which went through many editions. Glareanus was a man of profound erudition, and remarkable for his general knowledge. The emperor Maximilian I. bestowed on him the laurel crown, as a proof of his admiration of his poetry. His work, entitled *Dodecachordon*, in one vol. folio, 1547, now exceedingly rare, is important inasmuch as it makes us thoroughly acquainted with the state of music in the sixteenth century. He was a zealous advocate for the antient modes, in each of which, as he views them, he gives several compositions for many voices, chosen from the most esteemed works of the best masters of his time. These compositions will interest the practical musician more than the author's dissertations; though the latter can never be slighted by the musical historian, or by those who wish to penetrate deeply into what are now become the antiquities of the art.

GLARE'OLA. (Zoology.) [PRATINCOLE.]

GLARUS, a canton of the Swiss Confederation, is bounded north by St. Gall, east and south by the Grisons, and west by Schwyz and Uri. Its greatest length is about 32 miles, its greatest breadth about 16: its area is reckoned at about 469 square miles, of which only one-fifth is arable land. (Lereshe, *Dictionnaire Géographique de la Suisse*, 1836.) It consists mainly of the great valley of the Linth, which river crosses it from south to north, and of the Sernft Thal, or valley of the Sernft, which is an affluent of the Linth. There are also small valleys, such as the Klönthal, which open into the two principal ones. It is divided on the south from the valley of the Upper Rhine in the Grisons by a chain of lofty Alps, among which the summits called Dödiberg and Scheibe rise to 9000 or 10,000 feet above the sea. An offset of this chain detaches itself from the Dödiberg, and running northwards divides the waters of the Linth from those which flow into the Reuss through the valleys of Uri and Schwyz. To this offset belongs the high and extensive group called Glärnisch, 9,000 feet above the sea, and covered with perpetual snow, which extends into the canton of Glarus, and rears its head above the town of that name. The general inclination of the surface of the canton is towards the north, to the banks of the lake of Wallenstadt, and towards the low country between that lake and the lake of Zürich. Glarus is chiefly a pastoral country. There are about 8000 cows and 5000 sheep, and a vast number of goats. The green cheese called schabzieger is made here, and a great quantity of it is exported. But Glarus is also a manufacturing district, and has manufactories of printed cottons, muslins, silks, and paper. It imports corn, wine, salt, and colonial produce. Merchants from Glarus are established in many commercial towns of Europe. Quarries of slate and marble and iron-mines are worked in the mountains of Glarus.

The population of Glarus is about 30,000, of whom between 3000 and 4000 are Catholics. The government is a pure democracy: the Landsgemeinde, or general assembly of all males above the age of sixteen, is the sovereign power. It assembles every year, appoints its magistrates, and decides by show of hands upon the projects of law laid before it by the Landrath, or Executive. Ramond, in his additions to Coxe's 'Travels in Switzerland,' which he translated into French, gives a curious account of one of these Landsgemeinde of Glarus, which he attended, and of their mode of proceeding. The Landbuch, or law of the country, was printed in 1807. Several modifications have lately taken place in the constitution of the canton, especially with reference to the Catholic population, which enjoyed several privileges and had a separate judicial administration. One object of the reform is to place the whole population under the same administration, without distinction of religion.

Glarus has produced several great men; among others the historian Tschudi, whose family is one of the most distinguished in the annals of Switzerland.

The name of Glarus is a corruption of Hilarius, a saint in whose honour a shrine was built among these mountains. The abbey of Seckingen was at one time sovereign of this country, and all the inhabitants were serfs, with the exception of forty free families. The country passed afterwards under the dominion of the dukes of Austria. In the fourteenth century it joined its neighbours of the Waldstätten in their insurrection; and the battle of Näfels, which the people of Glarus gained over the Austrian forces, insured their independence.

It was through Glarus, and over the Alps which divide it from Schwyz and St. Gall, that Suwarrow, in his retreat in 1799, led his troops through paths thought impracticable, and first crossed the Bragel and then the Krauchthal, the latter at night by torch-light.

GLARUS, the capital of the canton, is a bustling and cheerful town, in a narrow part of the valley, on the left bank of the Linth. It contains 410 houses and 4000 inhabitants, 8 manufactories of printed cottons, one of woollen cloth, a cotton spinnery, some iron-works, a printing-press, and a number of mills. It has also a savings'-bank, an insurance company, and a branch of the Swiss Society for the Education of the People. A library has been formed for the use of schoolmasters. The parish church, an old Gothic building, is used for the service of both Catholics and Protestants. Zwingli was for ten years pastor of Glarus. The other remarkable buildings are the town-house, the hospital, and the new school. Vines are seen thriving near Glarus, notwithstanding the elevation of the ground.

(Raoul Rochette, *Lettres sur la Suisse*, vol. iii.)

GLASGOW is in the nether ward of Lanarkshire, on the north bank of the river Clyde, 43 miles west by south from Edinburgh, and 396 miles (by mail-coach road) north-west by north from London. The observatory is in 55° 51′ 32″ N. lat., and 4° 17′ 54″ W. long. The greatest length of the city, from east to west, is four miles and a half; its average width, from north to south, about two miles, comprising the whole of the antient royalty, the burghs of barony of Gorbals, Calton, and Anderston, together with parts of the two suburban parishes of Barony and Gorbals, which latter are situated on the opposite bank of the Clyde. The derivation of the name of Glasgow is not known. In the Gaelic language it signifies a grey-smith, and Gibson supposes the place to have received its present appellation from the circumstance of its having been in remote times the residence of a person of that profession. It is said that the Romans had a station on the site now occupied by the city, but its origin is generally attributed to St. Kentigern, or St. Mungo, who established a bishopric here in A.D. 560, and who, according to M'Ure and others, was a natural son of Eugenius III., king of Scotland. The monument of this individual is still shown beneath the choir of the cathedral, where his body was interred in the year 601. The place continued to be little else than a religious establishment until 1174—1180, when, by virtue of the charters of William, surnamed the Lion, it became a free burgh of barony, but not a burgh royal, as has been generally supposed, inasmuch as the burghal property was not held by its possessors immediately under the crown, and the rents were not due to the crown, but to the bishop. In 1190 the town obtained a royal charter for holding an annual fair: and in the early part of the thirteenth century it appears to have been governed by a provost, wardens, and baillies, who seem to have been independent of the bishop, and who possessed a common seal distinct from that used by the bishop and chapter. In 1450 William Turnbull, the then bishop of Glasgow, who was a person of great political influence in the councils of James II., obtained from that monarch a charter in favour of himself and successors, erecting the burgh and barony of Glasgow into a regality. This charter invested the bishops with very extensive power, and deprived the citizens of a privilege they previously possessed of electing their own magistrates. Towards the end of the fifteenth century Glasgow was changed from a bishopric to an archbishopric, the jurisdiction of which extended over the shires of Dumbarton, Ayr, Renfrew, and Lanark. In 1556, the royal burghs being taxed by order of Queen Mary, Glasgow appears to have been only the eleventh town in

Scotland in point of wealth. Before the Reformation, in 1560, the inhabitants are said to have been in a deplorable state of ignorance and superstition, attributable mainly to the ecclesiastical government to which they had hitherto been subjected; and even for a considerable time after that period the people retained their fierce and sanguinary disposition, which was strikingly characterized by their being constantly armed. In 1611 a charter was granted by James VI., not solely to the archbishop and his successors, but to the magistrates, council, and community: and in 1636, Charles I., by royal grant, incorporated them into one free burgh of regality, by which the city may be said to have been placed for the first time in the rank of a royal burgh holden of the crown. These charters relate to what is now called the antient royalty. To the westward the royalty was bounded by the old city wall (long since destroyed), and to the southward it is bounded by the Clyde. The last charter granted to the city is that of William and Mary, dated 4th January, 1690, and confirmed by parliament the 14th June following. By this charter, which has continued to the present day, the citizens are empowered to elect their own magistrates, provost, baillies, and other officers, as freely as the city of Edinburgh, or any other royal burgh in the kingdom. The corporation consists of a provost, five baillies, and twenty-three councillors; and by 3 and 4 William IV. cap. 76, the town-council are elected by the parliamentary constituency, one-third retiring from office annually. The provost, who, from courtesy, is still called lord provost, is justice of the peace for both the burgh and the county. He holds his office during three years, and is still re-eligible. The baillies exercise a jurisdiction in case of crimes and misdemeanors committed within the burgh not touching the life of the offender, and one of them sits daily in the council-chamber for the preservation of peace and the determination of petty causes and differences. The property of the corporation was estimated in 1829 at 212,146*l.*, and its debts at 78,308*l.* In 1833 the revenue was stated to be 15,340*l.*, and expenditure 15,117*l.* Previous to 1833, Glasgow, in union with the burghs of Rutherglen, Renfrew, and Dumbarton, returned only one member to parliament; but since the passing of the Reform Act the above constituency has returned two members. The arms of the city are an oak tree, a bird, a bell, and a salmon fish with a ring in its mouth; motto, 'Let Glasgow flourish.' For their origin, see an anecdote related by Bishop Spotiswood in his *History of the Church of Scotland.*

The southern part of the city, adjoining the Clyde, is situated on a tract of low land which becomes more elevated towards the north. It is regularly built; the greater part of the streets are sixty feet wide, and intersect each other at right angles; the houses, which are of stone, covered with slate, have an elegant appearance; and the squares, of which there are four, are tastefully planted with a variety of shrubs. The cathedral, or high church, dedicated to St. Kentigern, stands on the highest part of the city, and is considered the most perfect specimen of Gothic ecclesiastical architecture remaining in Scotland. It was commenced in 1123, by John Achaius, bishop of Glasgow; rebuilt in 1197, and completed in 1223-1260. Beneath it is a cemetery, used for some time after the Reformation as a subterraneous church, called the Barony Kirk, but now restored to its original use. The churches of St. Enoch, St. Andrew, and St. David, are also fine buildings. There are eleven benefices, nine of which have an income of 425*l.* per annum each, and are in the patronage of the town-council; the other two are in the patronage of the crown, with an annual income of 30*l.* each. The other public buildings which merit particular mention are the Royal Exchange, Royal Infirmary, Lunatic Asylum, the University, and the Hunterian Museum, which last, founded by the celebrated William Hunter, is built in the Doric style, and contains a splendid collection of books, coins, paintings, and anatomical preparations, valued at 65,000*l.* The market-places for butchers' meat, fish, &c., are said to have been much neglected; but that for live cattle is an exception, as it occupies more than six acres, is paved, and enclosed with stone walls. The Green of Glasgow, which Camden calls 'a public wash-house,' is now a fine park, stretching along the north bank of the river, and comprising upwards of 130 acres. Within the last twenty years more than 10,000*l.* have been expended in its improvement, and at the present time it is justly esteemed by the inhabitants for its great beauty and many important uses. The principal burying-ground is in imitation of Père la Chaise at Paris. The gaols are four in number, and the Bridewell is said to combine the important advantages of security and seclusion with strict classification. The banking establishments are numerous, and include a savings'-bank, established in 1815. The total rental of the city and suburbs in 1830-31 was 536,965*l.*; the assessed taxes levied during the same period amounted to 40,804*l.*; and the revenue of the post-office to 36,642*l.* The poor are provided for by an annual assessment, and by voluntary donations. In 1830 there were 5006 paupers in the city, the cost of whose maintenance amounted to 17,280*l.* Previous to the year 1800, the duties of watching and warding were performed by the citizens themselves. The town is now protected by a good police, the disbursements on account of which, in 1834, exceeded 15,000*l.* The town was first lighted with gas in 1818. The charge for a single jet is 6*s.* 6*d.* per annum; and the amount of rates paid by consumers in 1835 was 30,000*l.* There are two companies which supply the city with water filtered from the Clyde. These companies were established in 1806-1808, before which dates the inhabitants were but indifferently supplied from public and private wells. The average price of coal in 1831 was 6*s.* 3*d.* per ton; and in that year there were 561,049 tons brought into the town, of which about 124,000 tons were exported, the remainder being for the use of private families and public works in the city and suburbs. Till 1775 the Clyde was only navigable by vessels of very small burthen; but since that time large sums have been expended in its improvement; the banks have been widened, the bed deepened, and the numerous sand-banks and other obstructions to the navigation have been removed. In 1780 only vessels not exceeding 40 tons could come to the city; now, ships of nearly 400 tons have been loaded and discharged. Formerly, only lighters from Greenock came up to Glasgow; now, ships from America, India, and China come up with ease and safety. The spring-tides flow about four miles above the town, and the ordinary tides as far as Dalmarnock, which is two miles above the town. In 1834 the number of vessels which passed Renfrew Ferry was 2700. The revenue derived from the harbour and river-dues, exceeding 31,000*l.* per annum, is placed in the hands of trustees, who are members of the corporation. The river is crossed by five bridges, three of which are of stone: the oldest was built by Bishop Rae in 1350. There are three lighthouses, situated at Cumbraes, Cloch, and Toward. The air, though very healthy, is moist when compared with the east coast of England and Scotland, though the mean annual quantity of rain which falls (22·4 inches) is very little more than the annual fall at London, which is between 21·5 and 22 inches. The mean temperature of Glasgow, as determined by Professor Thomson, is 47·75°.

The situation of Glasgow, in the midst of a rich coal and mineral district, is more particularly adapted to a manufacturing than to a commercial city. It is connected with the Atlantic by the river Clyde, and communicates with the North Sea and German Ocean by means of the Forth and Clyde canal. Prior to the union in 1707 its commerce was limited to France and Holland, and consisted principally in the curing and exportation of salmon, but after that it entered so extensively into the trade with Virginia and Maryland, that before the commencement of the American war in 1776, which suspended the tobacco trade, the annual imports exceeded 50,000 hogsheads. At the present time the trade with the United States and the West Indies, and the timber trade with North America, are carried on upon a very large scale. The net receipts of the custom-house in the years 1833 and 1834 were 159,912*l.* and 263,945*l.* But Glasgow is far more a manufacturing than a commercial town. According to a report made to parliament in 1834, it appears that, with the exception of some large establishments at Aberdeen, the entire cotton manufacture of Scotland is confined to Glasgow and the country surrounding it to the extent of twenty-five miles. The manufacture of linens, cambrics, &c. was first introduced into Glasgow about 1725, the power-loom in 1793, and at the present time the numerous establishments for weaving and spinning are on the most splendid scale. But although the cotton manufactures have hitherto constituted the staple trade of Glasgow, those of iron become annually of greater extent, and from the peculiarly advantageous position of the town, in a mineralogical point of view, there is reason to expect that the latter will, at no distant

period, become of equal importance with those of cotton. In 1831 there were 355 steam-engines employed in the collieries, quarries, steam-boats, and manufactories belonging to the city. Letter-press printing was first practised in Glasgow in 1638 by George Anderson, and subsequently carried to great perfection by Robert and Andrew Foulis about the middle of the eighteenth century. [FOULIS.] The art of type-making was introduced in 1718, and that of stereotyping in 1818.

According to the population returns for 1831, the city and suburbs contained 202,426 inhabitants (93,724 males and 108,702 females), composing 41,965 families, of whom 26,586 were engaged in trade and manufactures, 299 in agriculture, and 15,080 were not comprised in the preceding classes.

The University and College-buildings of Glasgow, situated on the east side of the High Street, consist of two squares separated by a handsome library. The University was founded by a bull of Pope Nicholas V., granted in 1450, at the request of James II., by which power was given to establish a *studium generale* in the city of Glasgow. The charter of incorporation, granted by James II. in 1453, exempts the members from all taxes and impositions whatsoever. In its origin the University had no endowments or public buildings. The Faculty of Arts seems to have formed itself into a college from the very foundation of the University; and having afterwards received endowments, it acquired certain buildings in the High Street. In 1572 the college acquired some church property, and in 1577 James VI. made further additions to the endowments, and granted a charter which is the foundation of its present constitution. At an early period the University and the College of the Faculty of Arts were confounded in the language used in grants, and, as we may assume, in ordinary conversation. The adjudication of their respective rights was submitted to the Court of Session in 1771 and 1772. The office of chancellor of the university, which was formerly in the appointment of the crown, is now elective, and is held during life. The rector is elected annually by all the matriculated members; but the office has long been merely honorary, the practice being to nominate some person of literary or political distinction, who seldom resides in the town, or even appears there except at his inauguration. The university is governed by a senate consisting of the rector and the dean of faculty, the principal and the thirteen fellows of the college, and the five royal professors of the university.

The principal and college professors manage the college affairs, and are alone entitled to the benefit of the college funds. The professors called college professors, in addition to the principal, are those of divinity, moral philosophy, natural philosophy, logic, Greek, humanity, Hebrew, church history, mathematics, astronomy, law, physic, and anatomy. The university professors are those of natural history, surgery, midwifery, chemistry, and botany. The number of students in 1826-7 was 1027. There is but one session in each year, which commences 10th of October and terminates 1st of May. Originally the session was considerably longer, and the change is attributed to the extreme poverty of the students, who are unable to absent themselves from their homes during a greater portion of each year, and who are frequently compelled to earn their livelihood by pursuing some branch of industry while prosecuting their studies at the university. As in the other universities of Scotland, there are no apartments for the use of students, although some of the early donations were given on condition of chambers being provided for students of particular names and families. The academic course extends over four sessions, and whatever other classes the student may attend, he is obliged to take Greek the first year, logic the second, moral philosophy the third, and natural philosophy the fourth. At the commencement of each session the students undergo an examination in those subjects upon which they have been occupied during the preceding, in order to determine their qualifications for the new department upon which they are about to enter. The emoluments of the professors are derived partly from the fees paid by the students, which vary from three to five guineas, and as to the thirteen college professors, also from the funds of the college. The revenue in 1824 amounted to 9406*l.*, but we do not know how much belongs to the college and how much to the university. The expenditure for the same year was 8109*l.* There are ten exhibitions of the annual value of 132*l.* each, and four of 20*l.* each, tenable during ten years, for educating Scotch undergraduates at Balliol College, Oxford, besides numerous bursaries connected with the university, and varying from 5*l.* to 50*l.* The library, to which all the members have access, subject to certain regulations enacted by the senate, contains a large and valuable collection of books, including those of Dr. Robert Simson, the translator of Euclid's 'Elements,' and the medical works bequeathed by Dr. Hunter. For further information the reader is referred to the Report of the Commissioners on Scotch Universities, printed in 1831.

There is another institution, founded by Mr. John Anderson in 1795, and endowed by him with a library, museum, and philosophical apparatus. It was incorporated the following year, and placed under the superintendence of eighty-one trustees. The object of the founder was to give instruction to the operatives of Glasgow, free of expense, by means of popular and scientific lectures in natural philosophy, and the institution has already been productive of the happiest effects on a valuable class of society.

A mechanics' institution was founded in 1823. The principal lectures are upon chemistry, mechanical philosophy, anatomy and physiology. The library contains about 4000 volumes on science and general literature, and the average number of members is about 500. One remarkable feature in this institution is that free admission to the lectures and library is given to poor apprentices, one being admitted for every twenty tickets sold, and in this way upwards of 200 have been admitted since the opening of the institution. In the suburbs are other similar institutions, composed of more than 1200 members of both sexes, one half of whom attend the classes for the study of natural philosophy, geography, &c. The grammar-school of Glasgow is of remote antiquity. In 1823 there were 514 scholars, but the number has greatly decreased since that time, and in 1832 there were but 299. The teachers, of whom there are four, receive an annual stipend of 50*l.* each, and an additional fee quarterly of 13*s.* 6*d.* from each scholar. The whole is under the immediate superintendence of the town-council, assisted by the clergymen of the city and the professors of the university. Besides the Maitland club, which is similar to the Roxburgh club of London, there are many book societies and circulating libraries. The benevolent institutions of Glasgow are too numerous to admit of being detailed here, and we can only state that in support of them nearly 50,000*l.* was subscribed in 1834, exclusive of donations for charitable education, which alone amount to more than 24,000*l.*

Port-Glasgow.—Towards the close of the seventeenth century the citizens of Glasgow, having experienced great inconvenience from the want of a seaport, proposed making a harbour of Dumbarton; but being opposed by the magistracy of that burgh, on the ground that the great increase of inhabitants which such a measure would occasion would increase the price of provisions, they purchased in 1668 some lands adjacent to the village of Newark, and shortly afterwards obtained a charter from the crown for constituting them and the harbour, which was authorized to be built, a free port. In 1710 the burgh had already extended itself over the parish of Newark, a custom-house had been established, and a baillie appointed for the government of 'New Port-Glasgow and Newark.' The town, which is small, though well built, is situated fourteen miles below Glasgow, within the boundary of the presbytery of Paisley and synod of Glasgow and Ayr; and the harbour is capable of admitting vessels of considerable burthen. The magistrates exercise the same jurisdiction over the territory of the burgh as the magistrates of royal burghs. There are no guilds or corporations, or any persons entitled to exclusive privileges; neither is there any police establishment. The heritable property of the town is estimated at 28,000*l.*, the expenditure at 2500*l.*, and the debt at 26,925*l.* There are three large ship-building establishments, four sugar-refining houses, besides several manufactories, which are carried on upon an extensive scale. The population in 1831 was 5192. The town contains three schools, one of which is a grammar-school.

(Camden's *Britannia*; *New Statistical Account of Scotland*, 1836; Dr. Cleland's *Enumeration of the Inhabitants of the City of Glasgow*, folio, 1832; M'Culloch's *Statistical Account of Great Britain*; Sinclair's *Statistical Account of Scotland*; Playfair's *Description of Scotland*; M'Ure's *History of Glasgow*; Gibson's *History of Glasgow*; *Quarterly Journal of Education*; *Parliamentary Papers*, &c.)

GLASS, a transparent and impermeable substance, exceedingly brittle while cold, but which by the application of a high degree of heat is rendered so flexible and tenacious

that it may with the utmost facility be moulded into any form. It is so ductile while heated, that it may be spun into filaments of the greatest conceivable fineness, and these when cold are pliant and elastic in a high degree. The time at which glass was invented is very uncertain. The popular opinion upon this subject refers the discovery to accident. It is said (Plin., *Nat. Hist.*, lib. xxxvi., c. 26), 'that some mariners, who had a cargo of *nitrum* (salt, or, as some have supposed, soda) on board, having landed on the banks of the river Belus, a small stream at the base of Mount Carmel in Palestine, and finding no stones to rest their pots on, placed under them some masses of nitrum, which, being fused by the heat with the sand of the river, produced a liquid and transparent stream: such was the origin of glass.' The antient Egyptians were certainly acquainted with the art of glass-making. This subject is very fully discussed in a memoir by M. Boudet, in the 'Description de l'Egypt,' vol. ix., Antiq. Mémoires. The earthenware beads found in some mummies have an external coat of glass, coloured with a metallic oxide; and among the ruins of Thebes pieces of blue glass have been discovered. The manufacture of glass was long carried on at Alexandria, from which city the Romans were supplied with that material; but before the time of Pliny the manufacture had been introduced into Italy, France, and Spain (xxxvi., c. 26). Glass utensils have been found among the ruins of Herculaneum.

The application of glass to the glazing of windows is of comparatively modern introduction, at least in northern and western Europe. In 674 artists were brought to England from abroad to glaze the church windows at Weremouth in Durham; and even in the year 1567 this mode of excluding cold from dwellings was confined to large establishments, and by no means universal even in them. An entry then made in the minutes of a survey of Alnwick Castle, the residence of the Duke of Northumberland, informs us that the glass casements were taken down during the absence of the family, to preserve them from accident. A century after that time the use of window-glass was so small in Scotland that only the upper rooms in the royal palaces were furnished with it, the lower part having wooden shutters to admit or exclude the air.

The earliest manufacture of flint-glass in England was begun in 1557, and the progress made in perfecting it was so slow, that it was not until near the close of the seventeenth century that this country was independent of foreigners for the supply of the common article of drinking-glasses. In 1673 some plate-glass was made at Lambeth, in works supported by the Duke of Buckingham, but which were soon abandoned. It was exactly one century later that the first establishment of magnitude for the production of plate-glass was formed in this country, under the title of 'The Governor and Company of British Cast Plate-glass Manufacturers.' The members of this company subscribed an ample capital, and works upon a large scale were erected at Ravenhead, near Prescot in Lancashire, which have been in constant and successful operation from that time to the present day.

At an early period of its history in this country the glass manufacture became an object of taxation, and duties were imposed by the 6 and 7 William and Mary, which acted so injuriously, that in the second year after the act was passed one half of the duties were taken off, and in the following year the whole was repealed. In 1746, when the manufacture had taken firmer root, an excise duty was again imposed, at the rate of one penny per pound on the materials used for making crown, plate, and flint-glass, and of one farthing per pound on those used for making bottles. In 1778 these rates were increased 50 per cent. upon crown and bottle-glass, and were doubled on flint and plate-glass. These rates were further advanced from time to time in common with the duties upon most other objects of taxation, and in 1806 stood as follows:—on plate and flint-glass, 49*s.* per cwt.; on crown and German sheet-glass, 36*s.* 9*d.* per cwt.; on broad glass, 12*s.* 3*d.*, and on common bottle-glass, 4*s.* 1*d.* per cwt. In 1813 those rates were doubled, and with the exception of a modification in 1819 in favour of plate-glass, then reduced to 3*l.* per cwt., were continued at that high rate until 1825. In that year a change was made in the mode of taking the duty on flint-glass, by charging it on the weight of the fluxed materials instead of on the articles when made, a regulation which did not affect the rate of charge. In 1830 the rate on bottles was reduced from 8*s.* 2*d.* to 7*s.* per cwt. The only further alteration hitherto made in these duties occurred in 1835, when, in consequence of the recommendation contained in the thirteenth Report of the Commissioners of Excise Inquiry, the rate upon flint-glass was reduced two-thirds, leaving it at 2*d.* per pound, a measure which was rendered necessary by the encouragement given under the high duty to the illicit manufacture, which was carried on to such an extent as to oblige several regular manufacturers to relinquish the prosecution of their business. The number of establishments for the manufacture of glass in the United Kingdom, in 1833, was 126, of which 106 were in England, 10 in Scotland, and 10 in Ireland. The principal seat of the manufacture in England is at Newcastle-upon-Tyne and the neighbouring town of Shields; next in importance stands Stourbridge; then the works in and near Liverpool, including the Plate-glass Company's establishment at Ravenhead; next follow Bristol, Warrington, Birmingham, and Leeds; in London there were only three glass-houses, yielding to the revenue about 2 per cent. of the whole amount of duty collected upon this material. In Scotland five out of the ten houses are in and near Glasgow, two are in Leith, the remaining three are at Cartsdike, Portobello, and Alloa. In Ireland four manufactures are in Dublin, two each in Cork and Belfast, and one each in Waterford and Newry.

There are five distinct kinds of glass, which differ from each other in regard to some of the ingredients of which they are made, and in the processes of manufacture. These kinds are, flint-glass, or crystal; crown-glass, or German sheet-glass; broad-glass, or common window-glass; bottle, or common green glass; and plate-glass.

The principal ingredients used for the production of each of these kinds of glass are silex, or flint, and an alkali. The differences in the various kinds result from the description of alkali employed, and from the addition of certain accessary materials, usually metallic oxides. The form in which silex is now universally used in this country for glass-making is that of sea-sand, and care is required to select those kinds which are free from foreign matters and impurities. The port of Lynn in Norfolk, and Alum Bay in the Isle of Wight, have long furnished the greater part of the silex used in our glass-houses. Flint-glass derives its name from the practice in former times of using flints calcined and ground in the manner now employed for making porcelain, but this has long been discontinued. Of late there has been some apprehension of a scarcity of sand suitable to the manufacture, and a good idea may be formed as to the importance attached to the purity of this chief ingredient from the fact that sand has been imported for the purpose from New South Wales. The alkali employed for making fine flint-glass is pearl-ash, purified by solution and subsidence, in which process impurities to the extent of one-third of the weight are removed. Barilla, kelp, and wood ashes, combined with many impurities, are used for making inferior kinds of glass: the impurities even assist towards fusing the silex. Coarse alkaline substances all contain iron in some degree, and it is to the presence of this metal that the green colour of common glass is owing.

Flint Glass, known in other countries under the name of crystal, is the most generally useful, the most brilliant, and the heaviest description of glass. This last quality it owes to the large quantity of oxide of lead which it contains, and which is used sometimes in the form of minium, but more frequently in that of litharge. This metallic oxide acts as a flux, and promotes the fusion of the other materials at a comparatively low temperature. The greater density which it imparts to glass gives to it a greater power of refracting the rays of light, and it is this quality which renders flint-glass of so much importance for optical purposes. Nitre in a small proportion is used for the destruction of any carbonaceous matter in the other ingredients The oxygen which it gives out in the furnace further serves to maintain at their highest degree of oxygenation the metallic oxides that are present. Black oxide of manganese in minute proportion is also used to remove any foul colour that might otherwise remain through the impurity of the alkali used its cleansing property occasioned this oxide to be known formerly under the name of glass-soap. Any undue proportion of manganese would impart a purple hue to the mass, and if any considerable quantity be used that colour will be deepened almost to black. When through inadvertence the glass has been made purple, the colour will be almost instantly discharged by thrusting a

piece of wood into the melted mass. The cause of these changes is as follows: the purple colour given by oxide of manganese arises from its being in a high state of oxygenation, the wood when thrust into the heated mass becomes speedily carbonized, and the carbon, combining with the superfluous oxygen, is driven off in the form of carbonic acid gas; if by the addition of nitre the quantity of oxygen is again increased, it will combine with the manganese, and restore the purple colour. It will be seen from these circumstances how much skill and experience are necessary for the due mixture of ingredients so as to produce glass of the best quality. The manufacturers of flint-glass are generally unwilling to disclose the precise proportions in which they employ the requisite ingredients, and our knowledge on the subject must consequently be derived from scientific men who are not commercially engaged in the manufacture. Mr. Arthur Aikin, who has given much attention to the subject, recommends the following proportions:—

120 parts fine clean white sand,
40 „ well-purified pearl-ash,
35 „ litharge, or minium,
13 „ nitre; and a small (undefined) quantity of the black oxide of manganese.

The French chemists recommend a much larger proportion of oxide of lead, but this is found to make the glass inconveniently soft. Where less metallic oxide is used, more nitre is required as a flux, and *vice versâ*: the French chemists recommend only 2 to 3 parts of nitre, while Mr. Aikin recommends 13 parts.

The ingredients must all be intimately mixed together before they are put into the crucibles, or pots, which are previously placed in the furnace. As the bulk decreases by fusion, fresh portions of the ingredients are added until the pots are full of melted glass. A very strong and long continued heat is necessary, not only for the perfect fusion and amalgamation of the materials, but also for the discharge of the impurities which they contain. The chief of these, known under the name of sandivir, or glass-gall, consists of salts existing in the alkali which have but small affinity for silex, and from their specific levity rise in the form of a white porous scum to the top of the crucible, whence it must be removed before it is volatilized by the excessive heat of the furnace. This glass-gall is used as a powerful flux by refiners of metals. When the whole of the impurities have been thus thrown off by the action of heat and are removed, and the glass, or *metal* as it is called, appears colourless and translucent, the vitrification is known to be complete. The temperature of the furnace is then lowered by preventing the access of air until the glass loses a part of its fluidity, and assumes that pasty character which is the most convenient for the workmen, it being sufficiently consistent to be tenacious, but soft enough to yield to the slightest pressure without cracking or losing its tenuity. The material is usually brought to a perfect state of vitrification in about forty-eight hours from the first application of heat. There is perhaps no process of manufacture which excites so much the surprise and admiration of a stranger as that of fashioning flint-glass into all the various objects of convenience and ornament for which it is employed. To see a substance, proverbially brittle, blown with the human breath, pulled, twisted, cut, and then joined again with the greatest facility, never fails to strike with astonishment those who are unaccustomed to the sight. The tools with which all these operations are performed are of the most inartificial description, and do not appear to have received any improvement from the earliest records of the manufacture.

Glass of every kind would be even much more brittle than it is, so brittle indeed as to crack and break at every comparatively small variation of temperature, if it were not subjected, immediately after it is fashioned, to the process of annealing. [ANNEALING.]

Crown Glass.—This is the best description of window-glass. It is made without any mixture of metallic oxide, and is both specifically lighter and much harder than flint-glass. Many receipts have been given for the production of this kind of glass. At the great works of St. Gobain, in France, the mixture of ingredients is said to be—

Fine white sand	. .	100 parts,
Carbonate of lime	. .	12 „
Carbonate of soda, calcined	.	48 „
Clippings of crown-glass	.	100 „

with minute portions of manganese and cobalt to correct impurities, and to remove the colour which those impurities would impart: they are not therefore at all times necessary. In England the ingredients are mostly sand, kelp, and slaked lime, in the proportions of 200 pounds weight of the first, 330 pounds of the second, and 15 pounds weight of lime, to which is added about half the weight of the three materials in broken crown-glass, called by the makers *cullet*. The perfect fusion and refining of these materials are usually accomplished in about forty hours. Crown-glass of very superior quality is composed of

120 parts by weight of white sand,
60 „ purified pearl-ash,
30 „ saltpetre,
2 „ borax,
1 „ arsenic,

with the addition, if needed to correct the colour, of a minute quantity of manganese. Crown-glass is made by blowing, in the form of circular plates of 50 to 60 inches diameter. A quantity of glass in the pasty state is collected upon the end of a hollow iron tube, five feet long, similar to the tube used for blowing flint-glass. This lump of glass is then converted, by blowing through the tube, into a hollow globe of the requisite substance. This globe is flattened at the side opposite to the tube by pressing it upon a hard plane surface, and a solid rod of iron having a small quantity of melted glass at the end is applied, and adheres to the centre of the flattened side opposite to the tube, which is then removed by wetting the glass near to the point of union with the tube, leaving a small circular hole. To arrive at this stage the glass must have been several times re-heated, by placing it, when connected with the tube, within a small opening left for the purpose in the wall of the furnace. When transferred from the tube to the solid rod, called a *punt*, it must be again heated in the same manner, and is then twirled round by the workman somewhat in the manner that a mop is twirled to drive off the moisture; with this twirling the softened material is continually driven off from the centre by the centrifugal force; the hole just mentioned expands, and at length forms an annulus of a few inches wide, when suddenly, and in a most unaccountable manner, it flies open, and the whole substance is converted into a flat disc of circular form, and, except at the centre, where it is attached to the rod, of a uniform thickness. These centre parts are used for the commonest purposes, such as glazing outhouses and the like.

Broad Glass is an inferior kind of window-glass, made with a cheaper kind of alkali. The usual materials are three measures of sand, the same quantity by measurement of kelp, and six measures of soap-boilers' waste. This mixture, when vitrified and brought to the proper consistency, is collected upon the hollow rod, or pontil, and blown to the requisite size, when it is cut open with a pair of shears, and spread into a flat plate.

Bottle Glass is still inferior in quality to broad-glass, the alkali employed being the cheapest that can be procured, with the addition of a portion of lime to assist fusion. Considerable manufactures of bottle-glass are carried on at Newcastle-upon-Tyne, encouraged by the low price of the fuel (small coal) which is used in the furnaces. The ingredients are usually nothing more than lime and sea-sand, the latter article having been frequently wetted with sea-water, and allowed to dry, in order that the salt may be allowed to deposit itself in the sand; the soda contained in the salt is the only alkali, properly so called, that is used. Bottle-glass is fashioned by blowing, much in the same manner as flint-glass.

Plate Glass is both blown and cast. Plates which are blown are limited in dimensions, while those that are cast are made of very great size, the limit being caused by the expensiveness of the machinery required for the management of very large masses of the material. Plate-glass is necessarily costly, because of the numerous and laborious operations which it undergoes, and of the risks of fracture while subjected to them. The ingredients are chosen with the greatest care, and every possible amount of skill is brought to bear on the manufacture. The ingredients used are sand of the purest and whitest quality, and soda produced by the decomposition of common salt and lime: manganese and oxide of cobalt are added for the purpose of discharging colour. Soda is preferred to potash or pearl-ash because the glass that is made with it flows better when in fusion, a quality of much importance where large quantities are em-

ployed for the production of the same piece. The lime acts as a flux, and is used in proportions varying from 1-24th to 1-16th of the whole materials employed. Besides these ingredients it is necessary to use a large proportion of broken plate-glass, or cullet. The following proportions are given by Parkes:—

Lynn sand, well washed and dried	720	parts.
Alkaline salt, containing 40 per cent. of soda	450	„
Lime, slaked and sifted	80	„
Nitre	25	„
Broken plate-glass	425	„
	1700	parts.

It requires 40 hours' exposure to the full heat of the furnace to reduce the materials to the proper state of fusion and vitrification. When this is accomplished, the glass is transferred from the melting-pot, by means of copper ladles, to a large vessel called a *cuvette*, previously heated to a very high degree; when filled, it remains some hours in the furnace, to disperse the air that may have been introduced into the mass by the operation of ladling. When this effect has been produced, the cuvette is withdrawn from the furnace and taken to the casting-table, over the upper end of which it is raised and suspended by means of a crane. It is then thrown into an inclined position, and the contents are allowed to flow out upon the table, and are distributed by means of a roller over the whole surface of the table, bars of metal being placed at each side along its entire length, and across the bottom, in order to prevent the glass from running upon the floor. The casting of large plates of glass is one of the most beautiful processes in the arts: the large mass of melted glass, rendered in a high degree luminous by heat, which is poured forth, exhibiting changing colours in the sheet after the roller has been passed over it.

In the manufactory at Ravenhead, where the workmen are well trained and experienced, this operation is conducted with celerity and in silence, each of the twenty men engaged knowing well the part in the operation which he has to perform. Previous to the casting, the table is placed with one end against the mouth of an annealing oven, and as soon as the plate is set, it is carefully slipped from the surface of the table to the floor of the annealing oven, and when the oven has received as many plates as it will contain upon its floor, the door is closed and its crevices are stopped with mortar or clay, to insure the gradual cooling of the plates. They remain in the oven during a fortnight, after which the ovens are opened and their contents are withdrawn. The plates are then squared by means of a glazier's diamond, then ground and polished, and when intended for mirrors they are silvered. In order to their being ground they are imbedded in plaster of Paris, and first powdered flint is rubbed steadily and evenly over the surface by machinery worked by steam power, both sides of the plate being ground in succession. Emery powder is then substituted for ground flint, coarse at first, but finer afterwards as the rougher inequalities of the surfaces are removed: that part of the operation in which emery powder is used is called smoothing. The polishing is also performed by steam-machinery. The plates are firmly fixed upon large tables, and the polishing instruments, which are of wood covered with many folds of woollen cloth, having carded wool between each fold, are passed to and fro over the surface. The polishing substance used is colcothal, an oxide of iron which remains in the retorts after the distillation of acid from sulphate of iron: the two surfaces are polished in succession. For silvering glasses an amalgam of mercury and tin-foil is used, and this by means of considerable and long-continued pressure is made to adhere to one of the surfaces of the plate.

The processes here described are those used for the manufacture of cast-plate-glass. Plates which are blown are made in the manner described for making broad-glass; the after processes of squaring, grinding, smoothing, polishing, and silvering, are the same whether the plates are cast or blown.

Paste.—Artificial gems, familiarly known under the name of *paste*, are glass into the composition of which a large proportion of metallic oxide enters, such proportion being in almost all cases greater than that of the silex with which it is combined. The production of these mock jewels was formerly considered of much greater importance than at present, and a large part of every old treatise upon glass-making is made up of instructions for producing the best imitations of different precious stones. The processes recommended are in general tedious, and the directions given are very minute, several preliminary operations being described for purifying the ingredients used. The propriety of adopting different mixtures, independently of the colouring ingredients, which must of course be different for the imitation of different gems, is enforced by the fact that the different refractive and dispersive powers of those gems depend upon their specific gravity, and that in order to imitate each successfully the glass or paste employed should be of the same specific gravity as the stones to be imitated. The softness of all these compounds, when compared with that of the real gems, makes it impossible that any person resorting to such a test can be deceived with regard to their genuineness.

The foregoing description is confined to the explanation of those branches of the glass manufacture which, from their magnitude, are of the most importance. It would require a long treatise to explain minutely all the conditions necessary to be attended to in the processes, and to describe the variations which must be made in these conditions for producing the peculiar qualities of glass that are best adapted for other numerous purposes to which the material is applied.

The effect of high duties upon the consumption of articles of convenience is strikingly exemplified in the history of the duty upon glass in this country. In 1793, the year in which the war of the French revolution was begun, and when taxation was comparatively low, the quantity of all kinds of glass made and retained for use in the kingdom was 407,203 cwt., and the amount of revenue obtained from it 177,408*l.* The average rate of duty was therefore 8*s.* 8¾*d.* per cwt. upon the whole quantity. In 1834, the rate of duty was by progressive additions fourfold what it was in 1793, the average being 35*s.* 7½*d.* per cwt. upon the aggregate quantity used; and although the population had in the meantime increased more than 60 per cent., the quantity of glass which was taken for use was only 374,351 cwt., or one-twelfth less than was so taken in 1793. If the quantity used in proportion to the population had continued the same, that quantity would in 1834 have amounted to 663,740 cwt., and a revenue equal to what was realized would have resulted from an average rate of 20*s.* instead of 35*s.* 7½*d.*

The precise rates of duty charged upon each kind of glass at the two periods were as follows:—

	1793.		1834.	
Crown-glass	16*s.* 1¼*d.*	per cwt.	73*s.* 6*d.*	per cwt.
Plate-glass	21 5½	„	60 0	„
Flint-glass	21 5½	„	56 0	„
Broad-glass	8 0½	„	30 0	„
Bottle-glass	4 0¼	„	7 0	„

In 1835 the duty upon flint-glass was reduced from 6*d.* to 2*d.* per. lb., as already mentioned: the ultimate result to the revenue from this partial reduction cannot yet be fairly estimated; but it may well be doubted whether it can ever be judicious to extract revenue from an article of domestic manufacture, the ingredients for which are so cheap and so abundant as those from which glass can be made, and where the processes of manufacture are so simple in themselves that any person of ordinary talents may produce it illicitly, as it is well known many do in this country, in an attic or cellar. The quantity of each description of glass brought to charge by the excise, in each of the three years from 1834 to 1836, was as follows:—

	1834. Cwt.	1835. Cwt.	1836. Cwt.
Crown	136,708	155,328	163,928
Flint	83,323	81,674	102,653
Plate	18,922	21,652	22,169
Broad	6,766	5,847	7,629
Bottle	344,014	379,321	448,789

The real value of glass-ware exported from the United Kingdom, in each year from 1827 to 1836, was:—

1827	£534,549	1832	£402,757
1828	500,356	1833	445,845
1829	474,965	1834	496,872
1830	401,543	1835	640,410
1831	429,624	1836	553,384

The greater part of these exports was made to India and America. In 1836 the value of the shipments to various quarters of the world was as follows:—

To the north of Europe . . .	£22,210
To the south of Europe . . .	15,440
To Africa, including the Mauritius . .	18,412
To the East India Company's territories and Ceylon	129,796
To Arabia, China, and the Eastern Islands	7,239
To Australian Settlements . . .	37,110
To British N. American Colonies . .	103,481
To British West Indies . . .	69,550
To Foreign West Indies . . .	10,833
To United States of America . .	98,045
To Mexico, Brazil, and other parts of S. America	34,325
To Guernsey, Jersey, Alderney, and Man .	6,943
	£553,384

GLASTONBURY. [SOMERSETSHIRE.]

GLATZ, a circle in the Prussian government circle of Breslau and province of Silesia, part of the earldom of Glatz which was conquered by the Prussians in 1746, is bounded on the south and west by Bohemia. It lies in the heart of the Ratz branch of the Sudetsch mountains, of which the Hohe Eule, about 5524 feet in height, is at its northern extremity: it has an area of 336 square miles, and a population of about 73,000. The circle, which is watered by the Neisse, Biele, Erlitz, Westritz, &c., does not cultivate much grain, but rears cattle and horses, possesses several stone quarries, seven coal-mines, and produces garnets and other precious stones. Much spinning and weaving of yarns and linen are carried on.

GLATZ, the chief town, also called *Kladzko*, is situated on the Neisse, about 970 feet above the level of the sea, in 50° 15′ N. lat., and 36° 39′ E. long. It lies between two hills, the fortresses on which are considered master-pieces of engineering science. The town itself is defended by a double wall, and contains a government-house, an arsenal, a Roman Catholic gymnasium, 3 churches, an ecclesiastical seminary, 2 civic schools, an hospital, &c., and about 8600 inhabitants. There are several manufactories, chiefly of woollens, linens, plush, leather, tobacco, muslins, articles of wood, and rosaries.

GLAUBER, JOHN (called Polidore), born at Utrecht in 1646, studied painting under Nicholas Berghem, under whom he made a very rapid progress. Besides the fine works of his celebrated master, he had the advantage of seeing many works of the great Italian landscape painters at the house of a picture-dealer named Vylenburg, with whom he spent some years, studying and copying from the best works of the Italian painters. He then resolved to go to Rome, stopped a year at Paris with Picart, a flower painter, and two years at Lyon with Adrian Van der Cabel, and would have remained longer had he not been tempted to join the crowds going to the Jubilee at Rome. He stayed two years in that city, and as long at Venice, neglecting no opportunity of improvement. On his return home he settled at Amsterdam, and formed an intimate friendship with G. Lairesse, who often enriched his landscapes with elegant figures. Glauber is one of the finest Flemish landscape painters. His taste and manner were entirely Italian: most of his scenes are from the environs of Rome, and sometimes from the Alps. Many of his works are in the style of G. Poussin. He died in 1726, aged eighty.

GLAUBER, JOHN RUDOLF. This extraordinary man and laborious chemist was born in Germany, towards the close of the sixteenth century. He died at Amsterdam in 1668. His works were published at Amsterdam, and in 1689 they were translated into English by Mr. Christopher Packe, in one large folio volume. Although an alchemist and a believer in the universal medicine, he endeavoured to improve chemical processes and the arts to which they are applied. One of his most important discoveries is that of the salt which yet bears his name, and he greatly improved the processes for obtaining nitric and muriatic acids. In his works there is also a representation, though certainly a rough one, of the apparatus now known by the name of Woulfe's apparatus, used, as is well known, for the condensation of gaseous products arising in distillation. The production of vinegar of wood, afterwards called pyroligneous acid, now so largely employed in the manufacture of acetic acid, and various acetates used in the arts; the distillation of ammonia from bones, and its conversion into sal ammoniac by the addition of muriatic acid; the preparation of sulphate of ammonia, and its conversion into muriate by the agency of common salt; the production of sulphate of copper by acting upon green rust of copper with sulphuric acid, are among the more important of his numerous discoveries. The directions which he has given for the preparation of what he called his *sal mirabile*, Glauber's salt, or sulphate of soda, are in general sufficiently correct, and its properties are stated with considerable minuteness and accuracy.

He did much in improving and inventing chemical apparatus, some of which are described and depicted in his works. Although his works hardly repay a minute perusal, yet they contain much which excites admiration for a man who, in so early a period of chemical research, so greatly contributed to its advancement.

GLAUBER SALT occurs as a mineral body. It is found as an efflorescence, and also crystallized; the primary form is an oblique rhombic prism; cleavage parallel to the terminal planes; fracture conchoidal; colour white; streak white; lustre vitreous; taste cool, bitter; transparent; translucent; specific gravity 1·47. Before the blow-pipe it melts in its water of crystallization.

It is found in the salt-mines of Upper Austria, Hungary, Switzerland, and at Grenoble in France, and many other parts of the earth. Analyzed by Beudant, the specimens gave, from—

	Vesuvius.	Hildesheim.
Sulphuric acid	44·8	42·5
Soda	33·0	33·4
Water	20·2	18·8

GLAUBERITE, a mineral which occurs massive and also crystallized in rock salt. The primary form is an oblique rhombic prism. Fracture chonchoidal; hardness 2·5 to 3; colour yellowish and greyish-white; streak white; lustre vitreous; transparent; translucent; taste slightly saline; specific gravity 2·807. When immersed in water it becomes opaque, and is partly dissolved. Before the blow-pipe it decrepitates, and then melts into a white enamel.

It is found at Ocaña in New Castile, at Villa Rubia, ten leagues south of Madrid, and at Aussee in Upper Austria.

The specimen from Villa Rubia analyzed by Brongniart gave—

Sulphate of soda	51
Sulphate of lime	49
	100

GLAUCHAU. [SCHÖNBURG.]

GLAUCOLITE, a mineral which occurs massive, with a crystalline structure, and cleavage parallel to the planes of a rhombic prism, indistinct. Fracture uneven. Hardness, 5 to 6. Colour lavender blue, green; streak lighter. Translucent. Lustre vitreous. Specific gravity, 2·7 to 3·2. Before the blow-pipe it whitens, and fuses only on the edges; but melts with borax and phosphoric salt.

Found near the lake Baikal in Siberia. Analysis by Bergman:—

Silica	50·58	54·58
Alumina	27·60	29·77
Lime	10·27	10·08
Potash	1·27	4·57
Soda	2·96	0·00
Magnesia	2·96	0·00
	95·64	99·

GLAUCOMA (from γλαυκός, blue or bluish-grey), a disease of the eye, characterized by the pupil losing its naturally black colour, and presenting a clear or dull greenish hue. It was first described by Brisseau, partly from observations made in the post-mortem examination of the eyes of Bourdelot, physician to Louis XIV. It seems to depend essentially on disease of the choroid membrane and retina [EYE], generally combined with morbid alteration in the vitreous humour and hyaloid membrane, and in the lens and its capsule.

The symptoms by which it is indicated are pain in the head, over the brow, or across the forehead, weakness of sight, and a greenish colour of the pupil, most intense when one looks directly down into the bottom of the eye, where it seems almost as if there lay a piece of shining metal. The pupil is rather dilated, and the motions of the iris are slow. As the disease advances, the greenish colour becomes more marked, vision more and more indistinct, and at last, when it is entirely lost, the iris is quite motionless. Frequently the disease spreads to the lens, producing a glaucomatous cataract [CATARACT], and sometimes is accompanied with evident inflammation of the superficial parts of the globe.

The disease seems to consist in chronic inflammation of the deep-seated parts of the eye. Those of a gouty constitution, and especially those who have lived freely, and have passed the middle period of life, as well as persons of scrofulous constitution, or who are employed in very delicate work, are the most frequent subjects of it. It is also more frequent in some countries and classes than others. Scarpa never met with a case of fluidity of the vitreous humour during his long practice at Pavia; while in England such a condition is by no means rare in old persons. Benedict says that he found glaucoma very prevalent among the Jews in Breslau.

On examination of the eyes thus affected, the choroid membrane is found to have lost its black colour from the absence of pigmentum nigrum; it is become dull-brownish, and its vessels are often varicose; the vitreous humour is generally quite fluid without a trace of hyaloid membrane, of a yellowish hue, or with small brownish-green or green spots scattered through it; the retina is often darker than natural, or marked with reddish or black points; the lens in part of a yellowish or deep amber colour, firm and transparent, sometimes pushed forward, so that the iris is in contact with the cornea.

The only diseases with which glaucoma can easily be confounded are cataract and gutta serena; it may be distinguished by its history; by the greenish colour of the pupil, which evidently arises from changes of structure in the parts behind it, and which is not visible when viewed laterally; by the defect of vision being disproportionate to the change of colour of the pupil; and by the sight being best in a strong light.

Early treatment is necessary, and it should be actively antiphlogistic; blood should be drawn from the temples, and purgatives, mercury, and abstemiousness be ordered. These, if they do not put a stop to the disease, will retard its progress, and relieve many of its symptoms, as the headache, &c. If however the pupil becomes quite green and the iris motionless, the case may be regarded as hopeless; for there are no means known by which the changes on which these symptoms depend can be removed.

(Beer, *Lehre von den Augenkrankheiten*; Lawrence *On the Diseases of the Eye*; Mackenzie *On the Diseases of the Eye*.)

GLAUCONIE, a French term used principally by M. Brongniart, to signify some stratified deposits associated with the chalk, which correspond to the green sands of English geologists. The Glauconie Crayeuse is considered by M. Brongniart to be the equivalent of the upper green sand, and the Glauconie Sableuse of the lower green sand. The same author uses the term Glauconie Grossière for a deposit above the chalk.

GLAUCO'NOME, a fresh-water genus of conchifers of the family *Veneridæ*, established by Mr. Gray in his *Spicilegia Zoologica*. [VENERIDÆ.]

GLAUCONOME (Glauconome, Nereidis filia), is also used to denote a genus established by Goldfuss, for species of celluliferous Polyparia found in the chalk of Westphalia.

GLAUCO'PIS, a genus of birds established by Forster (*Calæas* of Bechstein and Vieillot).

Generic Character.—*Bill* moderate, strong, robust, thick, with the base enlarged towards the commissure; upper mandible convex, vaulted, curved towards the end and without any notch; lower mandible following the curvature of the upper, straight below, hidden in part by the sides of the upper mandible. *Nostrils* basal, lateral, round, partially closed by a large membrane, and entirely hidden by the curled and velvetty feathers which advance from the forehead. *Feet* strong, robust; tarsi longer than the middle toe; toes nearly all of a length, the external toe united to the middle one, and the internal toe soldered ('soudé') at the base. *Wings* short; the first quill short, the three following graduated, and the fifth longest. *Tail* long, graduated. (Temminck.) The above character is adopted in Lesson's 'Manuel,' and the following three species are there arranged under the genus, viz. *Glaucopis cinerea*, *Gl. leucoptera*, and *Gl. Temnura*.

M. Temminck describes the bird figured above as one-third larger than *Glaucopis Temia* (*Corvus varians* of authors), or the *Pie Temia* of Le Vaillant's birds of Africa. He observes that the striking character in *Gl. Temnura* consists in a very graduated tail ('queue très étagée'), all the feathers of which are truncated and cut, as it were, transversely at their extremity. The whole of the plumage is black, a little lustrous on the wings and tail. Bill and feet black. Total length 12 inches. Locality, Cochin China. M. Lesson observes that this species will form a new genus.

Glaucopis Temnura. (Temm.)

In Mr. Swainson's 'Classification of Birds' (1837), vol. ii., part 4, *Gl. Temnura* is referred to *Crypsirina*, and the following generic character is given by him: some of the characters, not inserted in his own notes, rest on the authority of the 'Manuel d'Ornithologie.'

Glaucopis (Forster). Bill short, strong, robust; the culmen elevated and curved from the base: upper mandible destitute of a notch; under mandible straight (on the gonys), the margin covered by that of the upper, and furnished at the base with two fleshy wattles. Nostrils basal, lateral, partly closed by a large membrane. Feet very strong, formed for walking. The tarsus longer than the middle toe: lateral toes short, of equal length, and divided to their base; hind toe strong, armed with long curved claw. Wings short. Tail rather lengthened, rounded; the feathers ending in setaceous points.—Pacific Islands. G. Cinerea.

In the third part of the 'Classification of Birds,' in the same vol., Mr. Swainson states that the *Glaucopinæ*, or rasorial crows, form the only division of the family which he had then analyzed with a view to determine its chief generic types. As a whole he thinks that they are distinguished from all other birds by their short finch-like bill, the commissure of which is always arched, and sometimes sinuated like that of a *Fringilla*. The genus *Glaucopis*, which he considers the pre-eminent type, shows this structure, in his opinion, in great perfection, 'added to another which is equally indicative of the rasorial structure, that is, strong walking legs. Following this we have the Senegal *Piapec*, forming our genus *Ptilostomus*, intimately related, according to M. Temminck, with his Corvus *Gymnocephalus*.' [CORVIDÆ, vol. viii., pp. 69, 70.] 'Upon this authority we conjecture the last-mentioned bird may prove the grallatorial type. The singular genus *Brachystoma*, from New Holland, long since noticed by us as connecting this bird with the jays, leads at once to the finch crows of India, all of which, in our opinion, are merely variations of that type named *Crypsirina* by M. Vieillot. Some of these, from their close resemblance to *Glaucopis*, have actually been placed id that genus by M. Temminck, who seems to have overlookes the entirely different structure of their legs. The circle in thus closed, and we find that these five types represent the primary divisions of the whole class.'

As Mr. Swainson has made some alterations in his ar-

rangement of the family *Corvidæ*, proposed in 'Fauna Boreali-Americana,' and inserted in the article on that family in Vol. viii. of this work, it becomes necessary to notice his more recent views. In the 'Classification of Birds,' (vol. ii., part 3) Mr. Swainson is of opinion that the *Corvidæ* are nearest allied to the *Hornbills*, although the intervening forms are few. The genus *Frigilus* (Fregilus ?) is the only representative he at present knows of that subfamily which intervenes between the *Buceridæ* and the *Corvinæ*. He observes that the whole family has never yet been analyzed, so that the leading divisions alone can yet be made out or stated with any degree of certainty; and says that the little value which can be attached to speculations on the rank of the present genera, founded upon mere synthesis, will best appear by looking to those artificial arrangements that place short-legged Rollers close to the long-legged and powerfully constructed Grakle (*Gracula religiosa*), two genera moreover which analysis has convinced him do not belong to this family. 'Nothing in short,' continues Mr. Swainson, 'is more easy than to divide a group like this into three, five, seven, or any other given number; but the divisions must always be considered as temporary, until confirmed by analysis. We have not yet carried our investigations so far as to lay before the reader an arrangement of *all* the genera of this family; nor will our space admit of an attempt to demonstrate those groups in it which we have already marked out. We shall therefore merely intimate what we conceive to be the only natural series, by arranging the genera, in our synopsis, under the following sub-families: 1. *Frigillinæ* (Fregilinæ ?); 2. *Corvinæ*; 3. *Garrulinæ*; 4. *Crypsirinæ*; and 5, *Coracinæ*.'

In the next paragraph (110) Mr. Swainson alludes to the *Corvinæ*, or typical crows, and to the *Garrulinæ*; the next (111) is occupied by his notice of the *Glaucopinæ* given above; and in the following (112) he excludes from the family *Epimachus*, as belonging to the suctorial birds; *Coracias*, as being completely united to *Eurystomus* by two species before him at the time he was writing, the latter being well known as a fissirostral group; and *Gracula*, as united to *Pastor* among the *Sturnidæ*. The Paradise Birds, hitherto arranged with the crows, form, in his opinion, the most aberrant group of his *Tenuirostres*, and one placed between the hoopoes and the honey-suckers. From the crows he proceeds to the starlings (*Sturnidæ*).

In the 'Synopsis of a Natural Arrangement of Birds' (part iv. of the same vol.), Mr. Swainson observes that 'there are a few alterations in the arrangement of the groups from what they appear in the foregoing part: this has resulted from further analysis, and by incorporating our researches up to the latest time.' We here find the *Corvidæ* thus arranged: *Subfamily* Corvinæ, *Typical crows*—Corvus. *Pica*, *Nucifraga*, Barita, *Vanga*, *Platylophus*, Phonygama. *Subfamily* Garrulinæ, *Jays*—Garrulus, Cyanurus, Dysornithia. *Subfamily* Glaucopinæ, *Wattle crows*—Crypsirina, Ptilostomus, Brachystoma, Glaucopis. *Subfamily* Coracinæ, *Fruit crows*—Coracina, Cephalopterus, Gymnocephalus. *Subfamily* Frigilinæ (Fregilinæ ?) which, he remarks, contains at present but two European birds (F. Pyrrhocorax and erythropus), which almost appear to be types of as many genera. The characters which he gives are, he observes, more strictly applicable to the first.

As far as this work has already proceeded, the reader will find a notice of *Corvus*, *Pica*, *Nucifraga*, *Garrulus*, and *Fregilus*, in the article Corvidæ; and of *Coracina*, *Gymnocephalus*, and *Cephalopterus*, in the article Coracina, (vol. viii.).

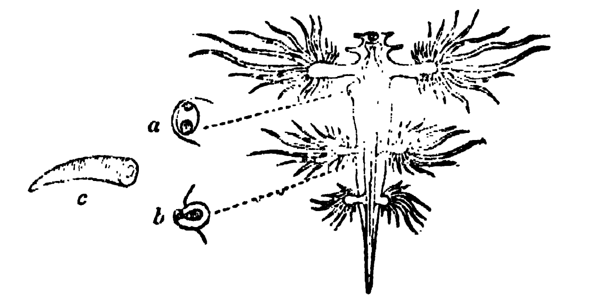
GLAUCUS (Zoology), Forster's name for a genus of mollusks, placed by Cuvier among his *Nudibranchiata*; by De Blainville under his *Polybranchiata* (Fam. Tetracerata); and by Rang made the type of a family, *Les Glauques* (Glaucidæ), which together with *Glaucus* comprises the genera *Laniogerus* (De Blainville), *Briaræa* (Quoy et Gaimard), *Eolidia* (Cuvier), *Cavolina* (Bruguières), and *Tergipes* of Cuvier.

Generic Character.—Animal pelagian, gelatinous, elongated, slightly flattened, and terminated backwards in a point. *Foot* very narrow and almost rudimentary. *Head* distinct, furnished with four very short, flattened, and triangular tentacula; the mouth subterminal. *Branchiæ* disposed in pairs on the sides, and fitted for swimming, being formed by oblong processes ('palettes oblongues') surrounded by digitated appendages. Termination of the organs of generation in a common tube, at the anterior part of the right side; vent on the same side, more backwards. (Rang.)

M. Deshayes, in his edition (1836) of Lamarck (who made *Glaucus* the first genus of his family *Tritonians*), remarks that, notwithstanding the researches of several accomplished naturalists, there still exists uncertainty as to many points of the anatomy of this genus. The description of M. de Blainville, he observes, leaves doubts concerning the organs of respiration; nor is it, he adds, certain that the digitations of the fins are branchiæ: in the opinion of M. Deshayes they are not. M. Quoy, he continues, says that these digitations are very caducous in the living animal, which detaches them when they are touched; and it is not to be believed that this would take place if these parts were destined for so important a function as that of respiration. M. Deshayes therefore points out the necessity of new researches as to the organization of these animals. The same zoologist states that the majority of naturalists are now convinced that, as yet, but one species is known; and he adds, that it must be confessed that the figures given are very inexact, with the exception of that given by MM. Quoy and Gaimard ('Voy. de l'Astr.,' Zool. t. 2, pl. 21, f. 6 to 14) which conveys a good idea of this elegant animal.

Mr. G. Bennett states that in April, 1835, during a voyage from England to Sydney, New South Wales, in lat. 4° 26′ N., and long. 19° 30′ W., with light airs and calms prevailing at the time, a number of damaged and perfect specimens of the *Glaucus hexapterygius*, Cuv., were caught in the towing-net, and placed in a glass of sea-water, where they resumed their vital actions and floated about, exhibiting a brilliancy of colour and peculiarity of form that excited admiration. The back of the animal, as well as the upper surface of the fins and digitated processes, and the upper portion of the head and tail, were of a vivid purple colour, varying occasionally in its intensity, appearing brighter in colour when the animal was active or excited, and deeper when it remained floating tranquilly upon the surface of the water. The abdomen and under surface of the fins were of a beautiful pearly white colour, appearing as if it had been enamelled. The usual length of Mr. Bennett's specimens, measured from the extremity of the head to the tail, when extended floating upon the surface of the water, was one inch and three quarters, sometimes one or two lines more or less. Mr. Bennett describes the body of the animal as subcylindrical, terminating in a tail, which gradually becomes more slender towards the extremity until it finally terminates in a delicate point; the head is short, with very small conical tentacula in pairs, two superior and two inferior; three (and in *G. octopterygius*, Cuv., four) branchial fins on each side, opposite, palmated, and digitated at their extremities, the number of digitations varying, the central digitations being the longest, and the first branchial fins, or those nearest the head, larger and more dense than the others. The body is gelatinous, and covered, he says, by a thin and extremely sensible membrane. 'When taken in the hand,' continues Mr. Bennett, 'the under surface of the animal soon becomes denuded of the beautifully pearly white it previously had, and at that time appears like a small transparent bladder, in which a number of air-bubbles are observed together with the viscera. On the abdomen being laid open a large quantity of air-bubbles escaped, and perhaps a query may arise how far they assist the animal in floating upon the surface of the water. The figure of *Glaucus hexapterygius* in Cuvier's work *Sur les Mollusques*, is tolerably well executed, but no engraving can convey to the beholder the inconceivable delicacy and beauty of this mollusk. In the engraving alluded to there is an inaccuracy, at least as compared with the specimens before me, in the digitated processes of the fins not being sufficiently united at the base: in the living specimens before me they were united together at the base, and then branching off became gradually smaller until they terminated in a fine point. Again, in the engraving in Cuvier's work, the anal orifice is placed on the right side, whereas in my specimens it was situated on the left; for, in all the specimens I examined I found the anus was disposed laterally, and could be plainly distinguished situated on the left side of the animal, a little below the first fin. This I consider also the orifice of generation, as in some of the specimens examined a rather long string of dots resembling ova was seen to protrude from it. One of the animals discharged from this orifice a large quantity of very light brownish fluid; this no doubt was the fæces.'

Numbers of the same species were taken by the same zoologist towards the end of the same month in lat. 2° 26′ N., long. 19° 51′ W., light airs, nearly calm. Often, when at rest, the animal would drop one or more of the fins, but on touching them they would be immediately raised to their former position, and the fin was turned back as if to throw off the offending object. Our limits will not permit us to follow Mr. Bennett through his detailed but interesting narrative of the habits of these beautiful creatures; but in addition to what we have given, the results of his observations appear to have been that the *Glauci* actually feed upon *Porpitæ*, and probably upon *Velellæ* and *Janthinæ;* that the animal shows more sensitiveness on the back than it does when touched elsewhere; that it does not seem to be disturbed by the contact of another *Glaucus;* that the fins have an undulating and a twisting movement; and that a circulating fluid could be perceived, by means of a glass, through the semitransparent membrane of the back, close to the surface, flowing in two directions—one taking a course downwards and the other upwards. It appears moreover, from the testimony of Mr. Bennett and others, that no means have yet been discovered for preserving these evanescent creatures, which lose their beauty and form even when taken alive out of the water and laid upon the hand. 'The digitations of the fins fell off, the least movement destroyed the beauty of the animal, it speedily lost all the deep purple and silvery enamelled tints, and became a loathsome mass.' (*Zool. Proc.* 1836.) Spirit, it is to be feared, would never preserve them in a state available for examination. We mention this to induce those observers who may have the opportunity, to follow out their researches on the animal's organization by watching it narrowly with good glasses whilst it is alive.



Glaucus. *a*, common tubercle of the organs of generation; *b*, vent; *c*, one of the digitations magnified. (De Blainville.) *a* would represent the anus, according to Mr. Bennett.

GLAZING, the art of fixing glass in the frames of windows, &c. The more common kinds of glazing hardly require any notice. Putty, with which the glass is usually fixed, consists of whitening and linseed oil. As to the mode of cutting the glass, see DIAMOND.

The defective state of most skylights, hothouse roofs, &c., shows that the art of glazing them is very imperfectly understood by those who practise it. When a skylight is glazed in the ordinary manner, the laps or horizontal joinings fill with water by capillary attraction whenever it rains, and the wind drives the water into the house. This process goes on as long as the shower lasts. Sometimes vegetable fibres hang down from the laps, and, acting as siphons, draw off the water taken up by them, which then falls into the house, and by its dropping injures tender plants, &c. The retained water also expands in freezing, and fractures the glass.

The following remarks are the result of long practical experience and careful observation. The edges of the glass which are to form the laps should not be cut straight, but circular: this will add to the beauty of the work, and cause the water to run down the centre of the openings, and not act so much on the bars. The cutting of glass in this manner for domes and other ornamental roofs, where the spaces between the bars are not parallel, has hitherto been difficult and expensive on account of the waste of glass; but by a contrivance recently invented, this may now be accomplished with ease, expedition, and economy. The laps should be less than a quarter of an inch wide, and wholly filled with a cement composed of putty, with a good proportion of lamp black, which will remain tougher and be more waterproof than white lead, carbon being much less soluble than carbonate of lead. Some glaziers cement the laps at the time when they are glazed, and leave a space in the centre to allow, as they say, the water that forms inside to run out. The spaces thus left are large enough to allow of the formation of sufficient ice to break the glass. Cementing is of little use, if done when the work is first glazed. After the glazier has left his work as finished, the glass, which is very elastic, springs up enough to leave the included cement loose and inefficient. The elasticity of the glass may be taken advantage of after the side putty is set firm. If the cement is then pressed into the laps and care is taken that they are dry, the action opens the laps, and the reaction of the glass closes them, and holds the cement fast and firm.

GLAZING. [EARTHENWARE, PORCELAIN, &c.]

GLEBE LAND, the portion of land belonging to a parish church over and above the tithes. If there be both a rector and a vicar, the glebe land in the occupation of either does not pay tithes, though if in the occupation of a tenant it does. The representatives of a deceased incumbent are entitled to the corn sown by him upon the glebe. Various statutes have from time to time been passed to facilitate the exchange of glebe lands, which are often scattered in small parcels in different parts of the parish. It is doubtful whether a parson may open mines upon his glebe, though he may work any that are open.

GLEE, in music, a vocal composition in three or more parts, any instrumental addition to which is absolutely illegitimate, because pernicious in effect; except in the case of unsteady performers, when the use of a piano-forte, gently touched, is advisable, as an evil of less magnitude than false intonation and broken time. The word is derived from the Anglo-Saxon ȝliȝȝ (*gligg*), which signifies *music* generally; hence the term *Serious Glee* may possibly not be so gross a solecism as is commonly supposed; though it must be also admitted that the word usually implied cheerfulness; and we are told by Warton that *gleeman* (ȝliȝman), answers to the Latin *joculator*.

The glee is of English growth, though the madrigal seems to have been its parent. The term is confined exclusively to this country, and does not appear to have been employed till towards the latter part of the seventeenth century; but Dowland, Ford, Ravenscroft, and others, published nearly a hundred years before compositions having all the character of that which subsequently took the name of *Glee*, frequently calling them part-songs, and occasionally applying the term madrigal to them, notwithstanding their deficiency in what chiefly characterises the latter.

Glees are called *serious* or *cheerful*, according to the sentiment of the poetry. The most distinguished authors of this delightful species of music are—(mentioning only those who now are personally beyond the influence of praise or censure)—Arne, Baildon, Callcott, Cooke, Danby, Hayes, Mornington, Nares, Paxton, Spofforth, Stafford Smith, Stevens, and Webbe. And we gladly seize the present opportunity to express our regret that, through inadvertancy, one of these names does not appear where it ought to have been placed in a former volume of our work. We offer this as some atonement to the memory of John Wall Callcott, Mus. Doc., a man of superior genius, of many acquirements, one of the finest of our glee-writers, and, in every sense of the phrase, a most valuable member of society. He was born in 1766, and at first educated as a surgeon, but soon adopted music as his profession. In his nineteenth year he gained three out of the four prize-medals given by the Catch Club, and seventeen more from that period to the year 1793. In 1785 he graduated at Oxford as Mus. Bac., and as Mus. Doc. in 1800. He died in 1806. (*Biographical Index to Mus. Lib.*)

GLEICHENIA'CEÆ, one of the divisions of the old natural order of Filices, or Ferns. It was intended to give an account of the whole race of Ferns in this place, but there appears so much probability of all that relates to this subject being put into a more satisfactory and intelligible condition in the course of a year or two, that the description of the order is referred to POLYPODIACEÆ.

GLEIM. [GERMANY, *Language and Literature.*]

GLENDWR, OWEN, was born in Merionethshire about 1349. He was maternally descended from Llewelyn, the last prince of Wales, whose grand-daughter Elena married Gryffydd Vychan, of which marriage Glendwr was the offspring. He appears to have had a liberal education, was entered at the inns of court in London, and became a barrister. It is probable that he soon quitted the profession of the law, for we find that he was appointed squire of the body to Richard II., whose fortunes he followed to the last,

and was taken with him in Flint Castle. When the king's household was finally dissolved, he retired with full resentment of his sovereign's wrongs to his patrimony in Wales. (Pennant's *Tour in Wales.*) He was knighted in 1387, and was married early in life to Margaret, daughter of Sir David Hanmer, of Hanmer, in the county of Flint, one of the justices of the King's Bench by the appointment of Richard II. By her he had several sons, and five daughters: most of his sons fell in the field of battle to which they accompanied their father in 1400.

Owen had engaged in a dispute about the boundaries of his lordship of Glendwrdwy with Reginald lord Grey de Ruthyn, an Anglo-Norman whose seignories adjoined his own. Taking advantage of the deposition of Richard, Lord Grey had forcibly possessed himself of a piece of land named Croeseu, which Owen, in the former reign, had recovered from him by course of law. Glendwr laid his case before parliament, but his suit was dismissed. To this provocation Reginald de Ruthyn added another insult, by purposely detaining the writ that had been issued to summon Owen, with the other barons, to assist Henry IV. in his expedition against the Scots. Lord Grey misrepresented to the king the absence of Glendwr as an act of wilful disobedience, and afterwards treacherously took possession of his lands, under the pretence of forfeiture. More temperate proceedings were advised by Trevor, bishop of St. Asaph; but no representations of Owen's power had any influence on Lord Grey. The Welsh were at this time little better than barbarians: they hated the English because of the laws which punished their bards as vagabonds, allowed no Welshman to hold the smallest public office in his native country, and maintained foreign garrisons in their towns and castles. They were hated in return as an ungovernable, plundering, rebellious race. (See Thierry's *Conquest by the Normans*, vol. iii., 355.) Out of their condition arose the power of Glendwr. With the assistance of the bards, who asserted him to be gifted with supernatural skill, his fame was spread through the whole of Wales, and his influence so rapidly increased, that, after levying a body of troops, he at once proclaimed his genealogy, and laid claim to the throne of Wales. In the summer of 1400 he attacked the estates of his enemy Lord Grey, and in his absence seized upon his lands. As soon as the news of these exploits had reached the king, he sent Lords Talbot and Grey to reduce Glendwr. Their attack upon his house was sudden, and he with difficulty escaped. He next marched upon the town of Ruthyn, which he took, pillaged, and burnt during the time of a fair, and then retired to his fortifications in the hills. His proceedings were so alarming that the king soon resolved to march against him in person. In September, 1400, a proclamation was issued from Northampton, commanding the lieutenants of Warwickshire, Leicestershire, and eight other counties, to assemble forces, and on a given day to join the regular army at Coventry.

A grant was also made to the king's brother, John earl of Somerset, of all Glendwr's estates in North and South Wales, in the hope that this powerful nobleman might be urged by the motive of immediate personal interest to dispossess the rebel of his property. Glendwr's revenue in money did not exceed 300 marks (200*l.*), but his rents in service and in kind were probably considerable. Notwithstanding all difficulties his ranks were continually increased by fresh recruits. The king, who had now (1400) penetrated as far as the Isle of Anglesea, plundered a Franciscan convent at Llanfaes, slew some, and carried away others of the monks (who were however eventually restored to liberty), and repeopled the monastery with English. The Franciscans were known to have assisted Prince Llewelyn, and to have espoused the cause of his successor. Henry at last caused his army to retire, for the further prosecution of his expedition had been rendered useless by the retreat of Glendwr and his troops to the mountains in the neighbourhood of Snowdon. At the suggestion of Prince Henry, a free pardon was offered to the rebels in several Welsh counties, which brought over to the king's authority thirty-two of the principal adherents of Glendwr. Nothing daunted by the diminution of his forces, but trusting as usual to the protection afforded by a mountainous country, Glendwr marched to Plinlimmon in the summer of 1401, and proceeded to ravage the surrounding country; he sacked Montgomery, burned the suburbs of Welsh Pool, destroyed Abbey-cwm-Hîr, and took the castle of Radnor, where he beheaded the garrison to the number of sixty. The Flemings (who in the reign of Henry I. had settled in Pembrokeshire), incensed at his incursions, raised a force of 1500 men, and were so expeditious in their movements, as, unexpected and unnoticed, to surround him at Mynydd Hyddgant. Hemmed in on every side, Glendwr broke through their ranks, and 200 of the Flemings remained dead upon the field. These depredations and victories awakened the fears of the king, and a second expedition into Wales was determined upon. Early in June (1401) the king was at the head of his troops, but after razing to the ground the Abbey of Ystrad Fflôr, and pillaging the county of Cardigan, he withdrew his army, already exhausted by famine and disease. The extent of the popularity of Glendwr's cause among the Welsh may be estimated by a complaint now made by the Commons to the king and the upper house of Parliament, that the Welsh scholars had left the English universities in order to aid in the rebellion at home, and that even the Welsh labourers had provided themselves with warlike weapons and quitted the service of their employers. In 1402 the event of a comet was interpreted by the bards as an omen most favourable to his cause. Predictions gave new energy to his followers, and Glendwr advanced towards Ruthyn, drew Lord Grey into the field, surprised him with an ambush, and carried him off captive to his camp near Snowdon; the prisoner's release was granted only upon the payment of 10,000 marks (6666*l.*), and on his entering into an engagement to observe a strict neutrality. For his better security, or perhaps by compulsion, Lord Grey married Jane, the fourth daughter of Glendwr, immediately upon his liberation. Being now free from English opponents, he turned his arms against such of his countrymen as had adhered to the English or forsaken his cause; he marched upon Caernarvon, and closely blockaded the castle.

The cathedral of Bangor, and the cathedral, palace, and canons' houses at St. Asaph, were destroyed at Owen's command. His excuse for these outrages was that Trevor, bishop of St. Asaph, had been disloyal to Richard, from whom he had received his preferment. Trevor subsequently revolted from King Henry, allied himself to Glendwr, and did not quit the see, in which Owen confirmed him, until that chieftain's fortunes declined, when he prudently retreated to Paris.

The king, determining upon a third expedition into Wales, called upon his principal subjects to assemble at Lichfield. In the mean time Glendwr had defeated Sir Edmund Mortimer at Pilleth Hill, not far from Knighton, in Radnorshire, and had left dead upon the field 1100 of Mortimer's followers, whose bodies were treated by the Welsh women with the most disgraceful indignities. Sir Edmund, who was himself made a prisoner, was uncle to Edward Mortimer, earl of March (then about ten years old), whose title to the crown having been acknowledged by the parliament, he was kept in close custody by the king. In consequence, we may suppose, of this relationship, Henry could not be prevailed upon to take measures for his ransom, a refusal which, joined to the humanity and respect with which he was treated by his captor, induced him to become a partisan of Glendwr, whose subsequent alliance with the Percies was mainly attributable to Mortimer. Instead of assembling the army at Lichfield, Henry determined to raise three separate divisions, and to attack the Welsh from three different quarters at the same time. It was arranged that the king should muster the first division at Shrewsbury; Lord Warwick, Lord Stafford, and others were to assemble the second at Hereford; while Prince Henry was to have the command of the third, at Chester. Owen Glendwr in the mean time made an inroad into Glamorganshire, burnt the houses of the bishop and archdeacon of Llandaff, set fire to Cardiff and Abergavenny, and then returned to oppose the English. Too prudent to hazard an encounter with a force far superior to his own, he concealed himself among the hills, driving away all the cattle and destroying all the means of subsistence. At this time the rebellion seemed likely to gain ground, for the confederates, Mortimer, the Percies, and Glendwr, confiding in their own power, determined to divide the whole kingdom among themselves, for which purpose they met at the house of Aberdaron, dean of Bangor, a descendant of Caradoc, prince of Wales, and strongly attached to the cause of Glendwr. They agreed upon the following allotments: Mortimer, in behalf of the Earl of March, was to take possession of all the country from the Trent and the Severn to the southern and eastern limits of the island; Northumberland claimed all lands north of

Trent; the district westward of the Severn was apportioned to Glendwr. It was at this juncture that Glendwr revived the antient prophecy, that Henry IV. should fall under the name of 'Moldwarp,' or 'the cursed of God's mouth;' and styling himself 'the Dragon,' assumed a badge representing that monster with a star above, in imitation of Uther, whose victories over the Saxons were foretold by the appearance of a star with a dragon threatening beneath. Percy was denoted 'the Lion,' from the crest of his family; and on Sir Edmund Mortimer they bestowed the title of 'the Wolf.' Owen, who was now at the zenith of his glory, called together the estates of Wales at Machynlleth, and there was formally crowned and acknowledged Prince of Wales. Some of his enemies however as well as his allies assembled at this meeting, and he narrowly escaped assassination.

In 1403 Glendwr and Mortimer marched towards Shrewsbury, in order to join their troops to the army of Percy, which was encamped near that town. It required all the vigilance of Henry to prevent this union; but by forced marches he succeeded in reaching their position when only a small portion of Owen's army had arrived. An engagement took place at Battle Field, three miles from the town, in which Percy fell. Little was done during the rest of this year beyond the king's securing the Welsh castles, and intrusting them to persons of tried fidelity. In the following year (1404) Owen Glendwr entered into a treaty, offensive and defensive, with Charles VI., king of France, which was concluded at Paris on the 14th of June. He then opened the campaign with fresh vigour, ravaged the enemy's country, took the castles of Harlech and Aberystwyth, and several others, of which many were dismantled and some garrisoned. In the beginning of the year 1405 Glendwr made an attempt to liberate the young earl of March, with the intention of making him contest the crown with Henry. He persuaded Constance, widow of Lord Spencer and sister to the duke of York, to assist in setting him free: by means of false keys she effected his escape, and was in the act of conducting him to Wales when they were seized and brought back. Constance was imprisoned, but the smith who had forged the keys met with a still severer fate, for both his hands were chopped off.

About this period (March, 1405) Owen's fortunes began to decline; he was attacked at Grosmont Castle, about twelve miles from Monmouth, and driven back by Henry, the young prince of Wales, then only seventeen years of age, to whom the king had intrusted the conduct of the war. Eight hundred men remained dead upon the field, as the English gave no quarter. During the same month he suffered a second defeat at Mynydd pwl Melyn, in Brecknockshire: in this engagement there were killed or made prisoners 1500 of Owen's followers; one of his sons was taken prisoner, and his brother Tudor fell in the action. After these reverses, all Glamorganshire submitted to the king, and Glendwr was compelled to wander over the country with a few faithful friends, concealing himself in remote and unfrequented places. There is a cave in the county of Merioneth, known by the name of Ogof Owain (Owen's Cave), in which he was secretly maintained by an old and trusty adherent. He is supposed to have instigated the conspiracy that was headed by Northumberland, but which, being speedily detected, was followed by the execution of several of the abettors: Northumberland found it necessary to fly to Scotland for protection. After quelling this revolt, the king marched upon Wales with an army of 37,000 men, but stormy weather and other contingencies forced him to retreat to Worcester.

It was fortunate for the declining power of Glendwr that the French now determined upon executing the scheme which had long been feared by the English and hoped for by the Welsh. A fleet of 140 ships, commanded by Renaud de Tric, admiral of France, disembarked 12,000 men at Milford Haven. Caermarthen capitulated: Haverfordwest was successfully defended by Lord Arundel. At Tenby, Glendwr joined them with 10,000 men, and from thence the whole army marched through Glamorganshire to Worcester, laying waste the country up to the very suburbs of the town. Henry now again took up arms, and made use of every means in his power to counteract the measures of so formidable an enemy. Lord Berkeley received orders to burn fifteen of the French ships that were lying at anchor in Milford Haven, and to intercept some others which were conveying stores and ammunition to the invaders. Hugueville, the commander of the French crossbowmen, and Owen, chose a strong position; the former encamped on a high hill, three miles from Worcester, a wide valley lying between him and the English; Glendwr posted himself nine miles from the town, on Woodbury Hill, which was surrounded by a fosse. The armies were arrayed before each other in order of battle for three successive days and nights, and repeated skirmishes took place, in which the loss that both sides sustained was computed at 200 men, besides the wounded: at the end of this time the French and their allies retired into Wales, having been harassed incessantly by the watchfulness of Henry's troops, who had cut off all their supplies. Shortly after this attempt the French quitted the kingdom in vessels that Glendwr furnished for their use. The castle of Llenbedr, in the county of Cardigan, surrendered the same year, on certain conditions, to Henry, prince of Wales: that of Coitie, on the river Ogmore, was besieged by Glendwr, and a loan was raised in both houses of parliament for the purpose of effecting the rescue of its owner.

Notwithstanding occasional assistance from his foreign allies, Owen's strength continued to decline: so many of his adherents deserted him, that he chiefly confined himself to the mountains, and rarely descended from them, except on predatory excursions. Two years afterwards, Glendwr again began to make head against the English by devastating the Marches and seizing the property of those who refused to join him; but Lord Powys, who was commanded by the king to take active steps against the renewed incursions of the rebels, fortified several castles, and would not permit his estates to be left unprotected, and subsequently took prisoners Rhys Ddu and Philip Scudamore, two of Owen's best officers, who were carried to London, where they were executed as traitors. Another similar effort proved unavailing, and Glendwr concluded a treaty with some of the lords-marchers, but it was disclaimed and rescinded by the king as illegal. Compelled to abandon this project, he retired into comparative obscurity. On Henry's death Glendwr, though still inaccessible, was so closely watched as no longer to be formidable. Still he carried on a petty and annoying warfare, which Henry V. at first endeavoured to put an end to by conciliation; but finding this method unsuccessful, he afterwards enacted several severe laws to restrain them. At the expiration of two years, the king deputed Sir Gilbert Talbot to negotiate a treaty with Glendwr, offering him and his followers a free pardon should they entreat it. The result of these proceedings does not appear: it is probable that they were interrupted by the decease of Glendwr. On the eve of St. Matthew, September 20th, 1415, after a life of risk and danger, this turbulent chief died a natural death, at the house of one of his daughters. There is a tombstone in the churchyard of Monnington-on-Wye, which is believed to mark his grave, but no inscription or memorial whatsoever exists to corroborate the tradition.

The Welsh pass an unjust censure upon Owen for his conduct at the battle of Shrewsbury; and not only blame him for omitting to join Percy's division before the engagement took place (which it appears he could not have effected), but also accuse him of want of promptitude and decision in not attacking Henry immediately after the action. Glendwr possessed many qualities which eminently fitted him for a warrior; he was active, enterprising, and courageous, and, when opposed to a superior force, both vigilant and cautious. He was rapacious, and careless of injuring others, but bitterly revengeful of any injury committed against himself. Cruel by nature as well as policy, he was the scourge rather than the protector of his country.

GLENOTREMITES (γλήνη, articular cavity, τρῆμα, a perforation), a genus of Echinodermata, with only one opening in the crust; established by Goldfuss, and by him compared to Cidarites; found in the chalk of Westphalia. (Petrifacta Germaniæ.)

GLIRES, the fourth order of *Mammalia* in the *Systema Naturæ* of Linnæus, who thus characterizes it:—Incisors (dentes primores incisores) two above and below; Canines (laniarii) none. *Feet* unguiculate; progression salient (*cursu salientes*). *Food* obtained by gnawing the bark of trees, roots, vegetables, &c. This is the character given in the Synopsis of the *Mammalia*. In the course of the work the dental formula is thus stated:—Incisors (dentes primores), two (bini) above and below, approximate, remote from the molars; no laniarii. The genera placed by Linnæus under this order in his last edition are, *Hystrix* (Porcupines),

Lepus (Hares, Rabbits, &c.), *Castor* (Beavers, &c.), *Mus* (Rats and Mice, Guinea-Pigs, Agoutis, Marmots, Lemmings, Hamsters, Dormice, Jerboas, the Paca, &c., and the American Flying Squirrel (*Sciurus Americanus volans*, of Ray), *Sciurus* (the Squirrels), and *Noctilio*, one of the Bats). [CHEIROPTERA, vol. vii., p. 25; RODENTIA.]

GLISSON, FRANCIS, was born in 1597 at Rampisham in Dorsetshire, was admitted at Caius College, Cambridge, of which he became Fellow, and after having graduated in medicine and been elected a Fellow of the College of Physicians, was appointed professor of physic in the university of Cambridge, which office he held for about forty years. He was also President of the College of Physicians. His writings show marks of considerable power and originality of mind, and contain some valuable information both in anatomy and physiology; but from his ideas having been obscured by the language of the Aristotelian philosophy, they have not met with that attention which they deserve. In 1654 he published an account of the anatomy of the liver, in which he described that prolongation of the cellular tissue, since called 'the capsule of Glisson,' which enters the substance of the liver together with the vena porta and hepatic artery, and accompanies their subdivisions to the ultimate lobules of which the organ is composed. He anticipated Haller in pointing out that property of muscular fibre to which that physiologist gave the name of irritability, for he argues 'motiva fibrorum facultas nisi irritabilis foret vel perpetuo quiesceret vel perpetuo idem ageret.' He distinguished accurately between perception and sensation, and gave as an instance of the former the action of the heart under the stimulus of the blood, or when removed from the body (that is to say, when stimulated by pricking, pinching, galvanism, &c.), and of the voluntary muscles when excited after death. He maintained that it was only through the medium of this natural irritability, and not directly, that motions were produced under the influence of the will; that the sensation of any external object is produced by an impression upon the natural perception of the organ, and that this impression is conveyed by the nerves to the brain. Thus light produces an impression on the retina, which is conveyed by the optic nerve to the brain, and causes that sensation which we call 'light.' That this view is correct is proved from the fact, that any stimulus applied to the retina produces the same sensation. In each instance we perceive the reaction of the retina under the external irritation.

He noticed the fact that when any part of the body is stimulated or thrown into action, those parts which derive their nerves from parts of the brain and spinal cord near to those from which the stimulated part derives its nerves are frequently thrown into action also, and he correctly explained this phænomenon by reference to the contiguous origins of their nerves. This view approaches nearly to that now known by the name of the reflex function of the spinal cord.

He described, as it would seem from his own work for the first time, the disease called the rickets, which, as he states, made its appearance about thirty years before the date of his work (1650), in the counties of Dorset and Somerset, and by degrees spread to London, Cambridge, and Oxford, and the southern and western parts of England, but had scarcely then reached the northern parts of the island. He named the disease Rachitis (ῥαχῖτις), in imitation of the popular name it had obtained before it was described by any medical writer.

His principal works are, 'Treatise on the Rickets,' by F. G. 1650; 'The Anatomy of the Liver, with some preliminary remarks on Anatomy, and some observations on the Lymphatic Ducts,' London, 1654; 'Tractatus de Ventriculo et Intestinis, cui præmittitur alius de partibus continentibus in genere et in specie de iis Abdominis,' London, 1677. They are all written in Latin.

GLOBBA, a genus of Scitamineous plants, indigenous in the tropical parts of Asia, especially in the islands of the Indian Ocean and the continent of India, where they extend as far north as 30° along the forest-clad base of the Himalayan mountains, and even ascend them to elevations of 2000 and 3000 feet; coming into flower in the rainy season. In a family abounding in highly ornamental plants, many of the species of Globba are likewise very showy; for the cultivation of which, in European latitudes, a climate and culture are required similar to that so successfully adopted for Orchideæ. The herbaceous parts yearly die down to the root-stocks; the leaves are distichous, lanceolate, with the sheaths split; inflorescence terminal, loosely panicled or racemose, flowers mostly yellow. In Globba is now included the genus *Mantisia*, which was so named from the resemblance of its flower to the mantis insect; and the species *saltatoria*, commonly called *opera-girls*, from the supposed resemblance of the flowers to dancing figures.

GLOBE, the common term for a sphere, but most frequently used to signify the earth itself, or the sphere on which a representation of the earth or heavens is drawn.

GLOBE OF COMPRESSION, a name given by Belidor to mines in which the highest charges of powder are employed. Such mines have been used by the besiegers of a fortress to destroy the galleries of the counter-mines and blow the wall of the counterscarp into the ditch. They were first employed by the king of Prussia, in 1762, at the siege of Schweidnitz.

GLOBULAR PROJECTION. We believe this term has been applied to more than one species of map, but particularly to the projection proposed by Lahire, in which the eye is supposed to be distant from the globe represented in whole or part by one half of the chord of an arc of ninety degrees. This projection gives but a small distortion, compared with that of the stereographic projection; it is however very rarely employed, on account of the projections of most of the great circles being ellipses.

GLOBULAR SAILING, a term of navigation, employed to denote the sailing from one place to another over an arc of a great circle, or the shortest distance between the two places. This involves a frequent (in theory, an unintermitting) alteration of the vessel's course; on which see NAVIGATION; MERCATOR'S CHART.

GLOBULARIA'CEÆ, a very small natural order of Exogens, nearly allied to Dipsaceæ and Asteraceæ, with which they agree in their simple ovary, solitary ovule, capitate monopetalous flowers, and epipetalous stamens. They are readily distinguished from those orders by their superior ovary. The species inhabit the hot and temperate parts of Europe, and usually possess bitter, tonic, purgative properties.

A twig of Globularia longifolia, in flower. 1. The calyx, corolla, and stamens in their natural position. 2. A corolla separate, with the stamens and style. 3. The ovary enclosed in the calyx, half of which is cut away to expose it. All magnified.

GLOGAU, a circle in the Prussian government circle of Liegnitz and province of Silesia, bounded on the north by Posen, has an area of 363 square miles, with about 62,000 inhabitants. It contains 5 towns and 218 villages. It is an agricultural district, and has few manufactures.

GROSS-GLOGAU, the chief town, is a strong fortress on the left bank of the Oder, in which is the Dominsel, a fortified island, with a citadel, connected with the town by a wooden bridge. Gross-Glogau is in 51° 58′ N. lat., and 18° 7′ E. long. It has about 550 houses, and, without the garrison, 11,100 inhabitants, among whom are 1500 Jews, and possesses a palace, 8 Roman Catholic churches, among which is the cathedral standing on the Dominsel, 3 Protestant churches, a synagogue, 2 hospitals, 2 gymnasia, &c. It manufactures woollens, stockings, meal, wax, paper, straw-hats, printed cottons, tobacco, &c.

GLOMMEN. [NORWAY.]

GLORIO'SA, a genus of the natural family of Liliaceæ, tribe Tulipaceæ, so named from the splendid appearance of its flowers. One species, *G. superba*, is indigenous in most parts of India, with a species or variety, *G. simplex*, at moderate elevations on the Himalayas, while *G. virescens* is a native of Senegambia. The root is fleshy, the stem climbing, the leaves lanceolate, undulated, and terminating in a tendril serving to support the plant. The six petals are undulated and reflexed, but pendent before flowering. The nearly horizontal stamens and declinate and oblique style give the flowers a very peculiar appearance, while their large size and the red and yellow colour of those of *G. superba* make it worthy of cultivation. This is successfully effected in hothouses. The fleshy root has a bitter and acrid disagreeable taste, and by some is said to be poisonous, but probably without sufficient foundation.

GLOSKOWSKI, a Polish poet of the seventeenth century, is the author of a religious poem entitled the 'Watch of the Passion of our Lord,' which, notwithstanding its rather odd title, is written in beautiful verse. It derives its name from being divided into twenty-four parts, called hours. It has gone through several editions, and is still much esteemed among the Protestants of Poland. He wrote also a poem in Latin entitled 'Geometria Peregrinans.'

GLOSS, GLOSSARY. [DICTIONARY.]

GLOSSOPETRA (γλῶσσα, *a tongue*, and πέτρα, *rock*), the name by which many early inquirers into the history of organic remains designated a great number of fossil teeth of fishes allied to the shark, which are found abundantly in the upper secondary and tertiary strata of England, France, Germany, Italy, &c. They were also called Lamiodontes, Odontopetræ, &c.

Amidst the difficulties which embarrassed the naturalists of the sixteenth century in their attempts to establish the true nature and origin of the organic remains of plants and animals found in the earth [GEOLOGY], the obvious resemblance between the fossil and recent teeth of fishes was a valuable and powerful argument. Fabio Colonna (*De Glossopetris Diss.*, 1627) and Agostino Scilla (*La vana Speculazione, &c.*, 1670) pointed out the close agreement, in several cases, between the fossil teeth of Malta, Calabria, &c., and the teeth of living sharks; and the argument from similarity of form was made complete by considerations of the peculiar polish, hardness, chemical quality, and even colour of the fossil specimens. Scilla's figures are excellent. Ray, in a letter to Dr. Robinson (1684), makes the same use of the Glossopetræ.

'Some other bodies besides shells, commonly esteemed stones, there are found in the earth, resembling the teeth and other bones of fishes, which are so manifestly the very things they are thought only to resemble, that it seems to me great weakness in any man to deny it. Such are the Glossopetræ dug up in Malta in such quantities that you may buy them by measure and not by tale; and also the vertebres of thornbacks or other cartilaginous fishes there found, and sold for stones, among the Glossopetræ, which have no greater dissimilitude to the teeth of a living shark, or the vertebres of a quick thornback, than lying so long in the earth, as they must needs have done, will necessarily induce. Now in this same Isle of Malta we found also many shell-like stones, which why we should not esteem to have been originally the shells of fishes I see no reason; for if in one and the same place we find many teeth and bones of fishes entire and unpetrified, and likewise stones exactly imitating the shells of other fishes, a great presumption to me it is that these were originally the things whose shape only they now seem to bear. Neither are these Glossopetræ found only in Malta, but also in many places of Germany, far remote from the sea; in a hill near Aken, in so great plenty, that Goropius makes it an argument they could not be the teeth of sharks. "In collo illo (saith he) qui Aquis-grano imminet, tantum id genus fuisse piscium uis crederet quantum de Glossopetrarum copiâ conjectari deberet?"'

Llwyd (1698), whose opinions on the real nature and origin of organic fossils were turned into a wrong channel by the apparent impossibility of understanding how the various animal and vegetable exuviæ could be placed in their subterranean repositories by the Noachian flood, a proposition which his judgment rejected, describes a considerable number of fish teeth according to the following method:—

Ichthyodontes cuspidati (considered to be incisor teeth of fishes). Such of those as are triangular in figure (sagittati), flat, with keen and often serrated edges, are called *Glossopetræ*.

Others which are more nearly round, elongated and pointed, he calls *Plectronitæ* (πλῆκτρον, a cock's spur).

Ichthyodontes scutellati (supposed to be molar teeth of fishes). Of these such as were round, umbonate, or scaphoid, were termed *Bufonitæ*.

The angular ones were called *Rhombiscus*.

The flattened pod-shaped teeth were called *Siliquastra*.

In Helwing's curious work, 'Lithographia Angerburgica,' (1717), the state of knowledge on the subject in Germany appears little advanced, since he takes the trouble to reject the supposition that the Glossopetræ were serpents' tongues. He describes several species of sharks' teeth under the titles of Glossopetra and Odontopetra.

Until a very recent period there was little progress made in the study of the parts of fossil fishes beyond the views of Llwyd. Neither the Glossopetræ nor the Bufonites were at all better understood in England, till the successful researches of Mantell in Sussex re-awakened the zeal of collectors; and Cuvier, besides renovating the whole subject of recent ichthyology, announced his intention of composing a systematic history of fossil fishes. The drawings which that great man had collected for the purpose were put into the hands of M. Agassiz, whose extraordinary zeal and success have made a new æra in fossil ichthyology. According to the views of this distinguished naturalist, all or nearly all the fish teeth known to the early collectors as Glossopetræ belong to the family of sharks, which must formerly have been more numerous and included more various structures than the living races. The Siliquastra and other of the scutellate ichthyodontes of Llwyd are likewise teeth of sharks.

The following short synopsis may be convenient to collectors (see also Dr. Buckland's 'Bridgewater Treatise'):—

Family of sharks.—Group 1. Cestracionts. (*Siliquastra*, *Rhombiscus*, &c. of Llwyd.) Teeth having a broad grinding surface.

2. Hybodonts. (*Plectronitæ* and *Glossopetræ* of Llwyd.) Teeth pointed, striated on both sides.

3. True sharks. (*Glossopetræ* of Scilla, Llwyd, &c.) Teeth triangular, striated on one side only.

Many of the Bufonitæ of old writers belong to the extinct genera Pycnodus and Gyrodus of Agassiz; though they have often been compared to the teeth of anarrhicas lupus, from which, according to Cuvier, they differ essentially in structure (*Règne Animal*).

The geological distribution of these fish teeth is curious. Llwyd mentions that scutellate ichthyodontes had not occurred to him in the maritime regions of England, but were found not less plentifully than the cuspidate kinds in the interior counties, as Oxford, Northampton, Gloucester, Berks, Bucks, &c. This is in agreement with conclusions of later date, for M. Agassiz has found that the whole group of Cestracionts is confined to strata of the transition and secondary series; while only one of the race (Cestracion Phillippi, or Port Jackson shark), is now living.

Dr. Buckland ingeniously remarks, that 'the greater strength and flattened condition of the teeth of the families of sharks that prevailed in the formations beneath the chalk had relation, most probably, to their office of crushing the hard coverings of the Crustacea, and of the *bony enamelled scales* of the fishes which formed their food.' (*Bridgewater Treatise.*)

GLOSSO'PHAGA. [CHEIROPTERA, vol. vii., p. 23.]

GLOSSO'PTERIS, a genus of fossil ferns, proposed by M. Adolphe Brongniart to include species whose elongated leaves or fronds are covered by fine arched dichotomous often anastomosing nervures. Examples occur in the carboniferous and oolitic systems of strata.

GLOTTIS. [LARYNX.]

GLOUCESTER, ROBERT OF, a metrical historian, whose 'Chronicle' was ably edited by Hearne, at Oxford, in 1724. He is presumed to have been a monk in Gloucester Abbey. His surname is unknown; and as several of his contemporaries, especially among the clergy, call themselves Roberts of Gloucester, no facts of his real history can be discovered. He is considered as the most antient of our English poets, and appears to have died some time in the reign of Edward I. The prose continuation of his history,

which follows the metrical version, is a composition as late as the time of Henry VI. (Nicolson's *Engl. Hist. Libr.*, edit. 1776, p. 51; Tanner, *Bibl. Brit. Hib.*, p. 636; Hearne's *Pref. to Rob. of Glouc. Chronicle*, §§ xvii. xxii.)

GLOUCESTER, or GLOCESTER, locally within the hundreds of Dunston and King's Barton, and the capital of the county to which it gives name: 51° 50′ N. lat., 2° 16′ W. long., 104 miles, direct distance, west-north-west from London. It is pleasantly situated upon a gentle eminence which rises on the eastern bank of the Severn, about a mile above the confluence of the two channels into which that river is divided by the island of Alney, and about 40 miles above its junction with the Bristol Channel. The origin of this city is generally attributed to the Britons, by whom it was called *Caer Gloew*, which, according to Camden, is derived from the British *Caer Gloyii iis*, or 'the city of the pure stream;' but according to other authorities, from *Gloew*, the name of the chief or original founder. Shortly after the invasion of the country under the Emperor Claudius, A.D. 44, the city became subjected to the Romans, who established a colony here as a check upon the Silures, or inhabitants of South Wales, and called it Colonia Glevum. Numerous Roman antiquities, consisting of burial-urns, coins, &c., together with a statera, or Roman steelyard (for a full account of which the reader is referred to Lysons and the 'Archæologia'), have been discovered at various times, particularly in the suburb of King's Holm, which is accordingly supposed to have been the more immediate site of the Roman settlement. The city continued in the possession of the Romans up to the period of their leaving the island. It subsequently surrendered to the West-Saxons about the year 577, and by them was called *Gleau-Cester*, whence its present name is derived. About the year 680, Wulpher, son of King Penda, founded the monastery of St. Peter, and so far improved the city, that at the commencement of the eighth century, according to Bede, it was considered 'one of the noblest of the kingdom.' It however repeatedly suffered from fire and from the ravages of the Danes, and in 1087 was almost wholly destroyed during the contest between William Rufus and the adherents of his brother Robert. In 1263 it was the scene of many battles between Henry III. and the Barons, whom he had offended by appointing a foreigner to the office of constable of Glocester Castle. In 1641-2 it espoused the cause of the parliament, and bid defiance to the king with an army of 30,000 men, in consequence of which the antient walls of the city were totally destroyed shortly after the Restoration.

Gloucester has been represented in parliament since 23rd Edward I., and now returns two members.

At a very early period the city was formed into a county by itself. Numerous charters have been granted by the kings of England, from Henry II. downwards; but the last and governing charter is that of Charles II., dated 1673. Under the Municipal Corporation Act, the city has six aldermen and eighteen councillors, and is divided into three wards. The average revenue of the corporation, as determined in 1832, is 4196*l.*, and its expenditure 4180*l.* There are but two courts, that of quarter-sessions and a court-leet. The main streets of the city are at right angles to one another; but although lighted with gas, they are ill-paved. The water for the supply of the inhabitants is partly drawn from the Severn, and partly from springs situated near Robin Hood's Hill, about two miles distant from the town.

Of the public buildings, the cathedral, dedicated to St. Peter, is particularly deserving of notice, not merely on account of its great antiquity and acknowledged beauty, but also because it contains so many perfect specimens of the various styles of architecture which characterized the different periods in which the several portions were erected. The most antient parts are the crypt, the chapels surrounding the choir, and the lower part of the nave, built between 1058 and 1089, the south aisle and transept in 1310-1330, the cloisters in 1351-1390, and the chapel of our lady towards the close of the fifteenth century. The fine Gothic tower, surmounted by four pinnacles of the most delicate workmanship, is of somewhat more recent date. Speaking of the choir of this cathedral, it is remarked in the Transactions of the Society of Antiquarians, that 'the great elevation of the vault, the richness of the design, the elaborate tracery which covers the walls, and the vast expanse of the eastern window, render it an almost unrivalled specimen of the florid style of architecture.' Among the numerous monuments in the interior are those of Robert, son of William the Conqueror, who, together with his brother Richard, was interred here; that of the unfortunate Edward II., of white alabaster; and that of Robert Raikes, the founder of Sunday-schools. Although suffragan bishops of Gloucester are mentioned as early as 1223, it does not appear that the city was erected into a bishopric with a dean and chapter until 1541 in the reign of Henry VIII. There are in all, eight benefices: one in the patronage of the bishop, of the annual net value of 154*l.*; one, before the Municipal Act, in that of the corporation, value 116*l.*; two in the gift of the dean and chapter, value 34*l.* and 284*l.*; three in the patronage of the crown, value 127*l.*, 113*l.*, and 231*l.*; and one vested in trustees, value 135*l.* The town-hall, wherein the courts of sessions are held, is a fine building with a portico of Ionic columns, erected by Robert Smirke in 1814. The county gaol occupies the site of the antient castle, described by Camden, and consists of a penitentiary, bridewell, and sheriff's prison. It was completed in 1791, at an expense of 34,873*l.*, and is said to be a very appropriate building. Not so the city gaol, which is very old, admits of no classification, and is otherwise inadequate to the necessities of the town. Previous to 1821 the cattle-markets were held in the open streets, to the great annoyance of the public. This has since been remedied by the corporation, who have erected a very commodious market at an expense of more than 10,000*l.* The market-days are Wednesday and Saturday; fairs, 5th April, 5th July, 28th September, and 28th November, for horses, cattle, &c., and particularly for cheese.

There are two stone bridges, each of a single arch, over the two channels of the Severn. These are connected by a paved road, called Over's Causeway, which extends through the rich pasture land of Alney island. The manufactures of Gloucester were formerly much more extensive than at the present time. That of pin-making, in particular, was once carried on upon so large a scale, that it is said the amount of this article conveyed in one year to the metropolis alone exceeded in value 20,000*l.* The town however is in a flourishing state, is surrounded by a large and most fertile district, and is rapidly advancing in competition with Bristol. It has a water communication with most parts of the kingdom, and the improvements in the navigation of the Severn, by the completion of the Gloucester and Berkeley canal, have added considerably to its foreign and domestic commerce. [BERKELEY.] According to the population returns for 1831, the city, consisting of the parishes of the Holy Trinity, Saints Aldate, John the Baptist, Mary de Crypt, Nicholas, and Owen, together with parts of the parishes of Saints Michael, Catharine, and Mary de Lode, contained 11,933 inhabitants. There are three schools, viz. the college school, the blue-coat, and the free grammar school of St. Mary de Crypt. The crypt school was founded by dame Joan Cook, in the thirty-first of Henry VIII., and is endowed with two exhibitions of value 50*l.* per annum each, and tenable during eight years, for the maintenance of two scholars at Pembroke College, Oxford. The college school was founded by Henry VIII., and has long enjoyed considerable reputation as a classical seminary. It is now under the direction of a master and usher, and is held in an apartment over the audit-room at the extremity of the north transept of the cathedral. The blue-coat school was founded in 1666, by Sir Thomas Rich, and is under the superintendence of the corporation, who appoint a master and matron, with an annual salary of 400 guineas, out of which they have to support and educate twenty boys. There are also a national school, established in 1817, a school on the Lancasterian system, founded in 1813, besides several Sunday-schools. Among the many benevolent institutions are several hospitals of antient foundation, the county infirmary, supported by voluntary donations, and a lunatic asylum. The poor-rates amount annually to about 4000*l.*

(M'Culloch's *Statistical Account of the British Empire*; *Itinerary of Antoninus*, by Reynolds, Camb., 1799; Gough's Camden's *Britannia*; Carlisle's *Endowed Grammar-Schools*; Brayley's *Beauties of England and Wales*; *Description of the City of Gloucester*, 1792; *Ecclesiastical Revenue Reports*, &c. &c.)

GLOUCESTERSHIRE, an inland county of England, situated in the south-west part of the island. The name is derived from that of its chief town, Gloucester. The boundary-line which divides Gloucestershire from the adjacent

counties is extremely irregular. On the east it is bounded by Oxfordshire, on the north by Warwickshire and Worcestershire, on the west by Herefordshire and Monmouthshire, and on the south by Somersetshire and Wiltshire. A small detached piece surrounded by Wiltshire is situated about five miles north-east of Malmesbury; and two other isolated parts are contained in the neighbouring counties of Warwickshire and Oxfordshire, not far apart from each other, about thirteen miles south-east of Stratford-upon-Avon. A detached piece of Wiltshire is situated in the south of this county, near Wotton-under-Edge, and there are some detached parts of Worcestershire in the north-east corner. The greatest length of the county from north-east to south-west is sixty miles, and its breadth from east to west is forty-three miles. The area is about 1256 square miles, or 803,840 acres, of which 750,000 are under cultivation, 6000 uncultivated, and 47,840 unprofitable. The population of the whole county was 387,019 when last the census was taken in 1831.

Surface, Hydrography, and Communications. — The county is naturally divided into three distinct districts, of very different character, which may respectively be termed the Hill, the Vale, and the Forest districts. The Hill district is formed by a range of high land running entirely through the county from north-east to the south and south-west. Its course is nearly parallel to the Avon and Severn, at a distance varying from six to ten miles, and running in a line from Chipping Camden to Broadway Beacon (1086 feet high), Winchcombe, and Cleve station (1134 feet), on to Cheltenham, which lies in a beautiful valley formed into a kind of amphitheatre by the western side of the hills. This range is called the Cotswold hills.* From Cheltenham the high ground runs south-west to Painswick, where it turns more to the south, and passes Wotton-under-Edge and Chipping Sodbury, and passes out of the county into Wiltshire and Somersetshire, forming the high ground around Bath. The Cotswold range of hills divides the basin of the Severn from the basin of the Thames.

Between Cheltenham and Dursley, near Stroud, there is a depression in the range, where it sinks to about 250 feet; but near Wotton-under-Edge it rises to 800 feet. Between Dursley and Wotton-under-Edge, this high ground spreads out, and a tract of lower elevation branches from it in a south-west direction, and enters Somersetshire a little to the west of Bristol. The extensive vale which lies between the Hills and the Severn is divided into the upper and lower, or the Vales of Gloucester and Berkeley. The former extends from the north of the county to Gloucester, and is about fifteen miles in length from north to south, and from east to west seven or eight. The boundary-line of the Vale of Berkeley is nearly a segment of a circle, the curved part of which is formed on the south and east by the hills which terminate on the north in the Painswick and Matson hills, and on the west the Severn forms the irregular chord-line; the extent of this vale from the foot of Matson Hill on the north to Aust Cliff on the south is twenty-five miles, and its medium breadth is not quite four miles. On the west of the Severn, and entirely divided by it from the rest of the county, is the Forest district, which has an irregular surface, and is chiefly occupied by the Forest of Dean, great part of which is still crown property. The centre of the forest is five miles south-west by west from Newnham. It is limited according to the perambulations made in the 12th of Henry III. and 10th of Edward I. Since that time many encroachments or grants of freehold property have been made on it, but the quantity of ground still retained by the crown is above 20,000 acres. The fine trees of this forest suffered much by an improvident grant made by Charles I. to Sir John Wyntour, of all the king's coppices and waste soil of the forest, except the Lea Bailey, with all the mines and quarries, in consideration of 10,000*l.* and a fee-farm rent of 1950*l.* 12*s.* 8*d.* for ever. At that time 105,557 trees were growing within the limits of the area so assigned. These trees were estimated to contain 61,928 tons of timber, besides 153,209 cords of wood. The civil commotions rendered the patent null; the inclosures which had been made were thrown down, and the whole re-afforested. A commission was issued at the Restoration to inquire into the state of the forest, and it was found then to contain 25,929 oaks and 4204 beeches, which would supply 11,335 tons of ship-timber and 121,572 cords of wood. A re-grant was then made to Sir John Wyntour of all the trees except those which would furnish timber for the navy. Numerous fellers of wood were immediately employed by him, and the destruction of the wood became so rapid and fearful that parliament interfered to prevent further mischief by introducing a bill restraining him in this work of devastation. Before the bill could be passed however the parliament was prorogued, and Sir John was left to hew down the trees at his pleasure. On a new survey being made in 1667, it was found that only 200 of the oak and beech trees were still standing, and a deficiency appeared of between 7000 and 8000 tons of the timber which should have been reserved for the navy. Eleven thousand acres were then immediately inclosed, planted, and carefully watched, in order in some measure to replace the valuable timber thus destroyed. From the plantations then made the supply for the dock-yards has been for some time principally obtained.

The government of the forest is vested in a lord warden, who is constable of the castle of St. Briavel's, six deputy wardens, four verderers chosen by the freeholders, a conservator, seven woodwards, a chief forester in fee, and bow-bearer, eight foresters in fee, a gaveller, and a steward of the swanimote. The forest is divided into six walks: and these officers are empowered to hold a court of attachment every forty days, a court of swanimote three times in the year, and another court, called the Justice Seat, once in three years. These courts are held at the King's Lodge or Speech House, situated nearly in the centre of the forest. The whole forest is extra-parochial, and its inhabitants are exempted from rates and taxes, have free liberty of pasturage, the privilege of sinking mines, and access to the woods and timber for their works. One-sixth of the produce of the mines is due to the king. The extra-parochial inhabitants in the forest in 1831 were 7014; of these more than 800 males, twenty years and upwards, were employed in mines, quarries, and coal-pits. Little more than a hundred years back the six lodges erected for the keepers were the only houses in the forest, and in 1831 the number amounted to 1212. The general appearance of the Forest of Dean is picturesque, and abounds with apple-orchards, from which very fine cider is made.

The principal rivers in Gloucestershire are the Severn, the Wye, the Lower and the Upper Avon, the Frome, the Isis or Thames, the Calne, the Windrush, and the Ledden. The Severn enters the county from the north a little to the west of Tewkesbury, where it is joined by the Upper Avon, and the united stream takes a winding south-south-west course to Gloucester. Near Gloucester, commencing at Maisemore, this river divides into two branches, which re-unite a little below the city, inclosing a small tract of land called Alney island, comprehending many acres of fine pasturage. From Gloucester the Severn continues its course, which though very winding still takes the same general direction to Newnham, below which it widens considerably, passes near Berkeley, and at length becomes a broad æstuary, into which the Wye and the Lower Avon fall. From its entrance into the county to the mouth of the Avon, the Severn, following all its windings, is sixty miles long. In the æstuary of this river opposite the mouth of the Lower Avon, the tide rises forty-two feet. The Severn contains roach, dace, bleak, flounders, eels, elvers, chub, carp, trout, and perch. Salmon, lampreys, shad, shrimps, plaice, soles, conger-eels, cod, and sturgeon belong to the sea, but are taken within the limits of the county; the four last are seldom found higher than Berkeley hill. The Severn salmon has for some years become a scarce fish.

The Lower Wye forms the boundary between this county and Monmouthshire and a small part of Herefordshire, bounding the south-east of the latter county for eleven miles and the east of the former for twenty-one miles of its course. At Chepstow, near the mouth of the Wye, the tide sometimes rises sixty and seventy feet.

The Lower Avon forms the boundary on the south-west for about eighteen miles between this county and Somersetshire, passes through Bristol, and falls into the æstuary of the Severn after a course of about seven miles north-west from that city.

The Upper Avon only divides a very small part of this county from Warwickshire on the north-east, and after a winding course through a small part of Warwickshire and Worcestershire it flows in this county for five miles, till it falls into the Severn near Tewkesbury. Roach, dace, bleak, carp, bream, and eels, are caught in the Upper Avon.

* From sheep-cotes, and wolds, or hills, formerly called wolds.—Camden's Britannia.'

The North Frome, a small stream which rises a little south-west of Wickwar, flows for a short distance north-west, then turns to the south, passes near Iron Acton and Stapleton, enters Bristol on the north side of the city, and passing through its centre falls into the floating-dock of the Avon. In its short course it supplies a number of mills and manufactories, and in its last half-mile it is used as a dock and harbour.

The Ledden, which has its source in Herefordshire, a few miles north of Ledbury, enters this county near Donnington, and after a south-east course, passing by Dymock, falls into the east branch of the Severn at Alney Island; its course through this county is about sixteen miles.

The Stroud rises near Brimpfield, passes on to Stroud, and joins the Severn seven miles south-west of Gloucester.

The Calne, or Colne, one of the principal streams which unite in forming the Thames, has its source a little to the east of Cheltenham, and taking a winding course to the south-east passes by Shipton, Withington, Coln St. Denis, Colne St. Aldwins, and Fairford, and joins the other streams which unite with the Thames at Lechlade. The Leach, another small tributary of the Thames at Lechlade, rises near North Leach.

The Windrush rises near Winchcomb, and taking a south-east and then an east course passes into Oxfordshire, a mile or two west of Burford.

One of the sources of the Thames, or (as it is frequently called in its upper part) the Isis, is at Thames Head, near the road from Cirencester to Tetbury. This stream immediately passes into Wiltshire, and soon joins the Swill brook, which, united with another stream from another source of the Thames, passes by Cricklade (in Wiltshire), near which place it receives the Churn, another small affluent which rises within three miles of Cheltenham, on the east side of the hills, and passes Cirencester. From Cricklade the Thames flows to Lechlade, and becomes for a few miles the boundary between Gloucestershire and Wiltshire. From the source of the Swill at West Crudwell to Cricklade the stream is 10½ miles long, and from Cricklade to Lechlade it is 9½ miles: at Lechlade it becomes navigable.

The Thames and Severn canal connects the two great navigable rivers. It commences at Lechlade, and joins the Stroudwater canal at Wallbridge near Stroud. Its whole length from Lechlade to Wallbridge is 30 miles and 7 chains; from Lechlade to near Coates it is 20⅝ miles, with a rise of 134 feet by 14 locks. Near Coates begins the Sapperton tunnel, 2⅜ miles long, which is the summit level of the canal. The arch of the tunnel is 15 feet wide in the clear and 250 feet beneath the highest point of the hill, which is of hard rock, some of it so solid as to need no arch of masonry to support it; the other parts are arched above and have inverted arches at the bottom. From the end of the tunnel at Sapperton to Wallbridge, a distance of 7⅝ miles, there is a fall of 243 feet by 28 locks. The last 4 miles of the canal is of the same width and depth as the Stroudwater canal, and calculated for the Severn boats; the remainder of the line is 42 feet wide at top, 28 feet at the bottom, and 5 feet deep; the locks admit boats of 80 feet in length and 12 feet wide. At Siddington St. Mary a branch about a mile in length runs to Cirencester from this canal; and at Latton it is joined by a branch of the Wilts and Berks, originally called the North Wilts canal.

The first act of parliament for making this navigation was passed in 1783, and in November, 1789, the first vessel passed from the Severn into the Thames.

The Stroudwater canal commences at the Severn, near Framiload, about seven miles between Gloucester, and thence runs in a south-east direction by Whitminster, near which place it is crossed by the Gloucester and Berkeley canal. It continues the same course and terminates in the Thames and Severn canal at Wallbridge. The length is rather more than eight miles, with a rise of 102 feet 5 inches. The first act of parliament for making this canal was passed in 1730, but nothing effective was done until 1760, where a third Act was passed relating to this undertaking.

The Hereford canal, which is intended to connect the towns of Gloucester and Hereford, is not yet completed, and at present (February, 1838) reaches only from Gloucester to Ledbury, a distance of 18 miles, with a rise of 195½ feet.

The Gloucester and Berkeley canal, by which the navigation up to Gloucester is shortened 11½ miles, was projected in 1793; but it was not completed till 1826. From the basin of this canal in Gloucester, a railway runs to Cheltenham, a distance of nine miles. Acts were passed relating to this undertaking in 1800 and 1815. Its completion has been of great advantage to the town of Cheltenham, where, on its opening, a very large reduction in the price of coals immediately took place.

Medicinal springs considered of much efficacy occur in this county; those of Cheltenham and Clifton have been long celebrated, and one has recently been discovered near Gloucester, which it is said surpasses those of Cheltenham in its strength and effects.

The high road from London to Gloucester and thence through Herefordshire and South Wales enters this county at Latton near Cricklade, and passing through Cirencester and Gloucester, leaves the county about 4 miles short of Ross. The road from London to Cheltenham and so on to Tewkesbury, thence branching through Warwickshire and Worcestershire, enters the county at Little Barrington, about ten miles from North Leach. The London road to Bristol and thence to the South of England enters the county at Marshfield. The direct road between Bristol and Gloucester is continued with numerous branches to the North and to Liverpool. The road between Gloucester and Cheltenham leads also with numerous branches in all directions to the east of the island. A road extends from Gloucester through the Forest of Dean to Chepstow, and the forest is likewise intersected by several other roads.

Geological Character.—The whole range of the Cotswold belongs to the lower division of the oolitic series. The great oolite forms a flat table-land on the summits: and on the western escarpment beds of fullers' earth, inferior oolite, and marly sandstone occur. The summits of some few of the detached hills east of the great range are capped by the sandy beds of the inferior oolite. The whole of the Vale district rests on the lias formation. The south-west corner of the county is occupied by the coal-field, which commmences near Wickwar on the north and continues into Somersetshire. [COAL-FIELDS.] The whole of the Forest of Dean is a coal-field encircled by an elevated border of carboniferous limestone and old red sandstone.

The fossils of this county are extremely numerous, and are found both in the hills and the vales. There are some beds near the bottom of the lias series which occur in the cliffs of Westbury and Aust, in which are numerous remains of vertebrated animals; they are well known to the collectors of that neighbourhood under the name of the 'bone-beds.' Asteriæ are abundant at Pyston in Lydney parish and under the adjacent cliffs on the banks of the river; they are also found at Lassington, Dursley, Sherbourn, and Robin Hood's Hill. The asteriæ columnares have been found in the quarries at Winrush. In the parish of Abstone are belemnites. On the descent of the hill from Cross Sands to Sodbury the banks on each side are full of belemnites, ribbed nautili, &c.; and in a quarry near the entrance of that town are various masses of bivalve shells. Various coralloids, anomiæ, cochleæ, and other fossils are found at Sherbourne, Northleach, Dursley, &c. Coal-beds, alternating with ironstone, occupy the whole of the Forest of Dean. Iron appears to have been wrought here during the Roman occupation; and we find it recorded in the reign of Edward I. that there were then 72 furnaces for smelting iron in this forest. The iron ore here is not very rich in metal, and it is now therefore comparatively little worked. Two hundred pits have been opened for the coal in different parts of the forest, but the coal is not considered so good as that of Staffordshire. The coal-beds in the neighbourhood of Bristol alternate with ironstone, but the latter is not worked; the coal supplies the immense consumption of the manufactories of Bristol. Lead-ore is found in many parts of the county, but not in sufficient quantities to defray the expense of working. Pyrites, or sulphuret of iron, has been found in great abundance and in various forms of combination, but is not applied to any useful purpose. Lapis calaminaris, or oxide of zinc, is found at Redland and Yate, and in small quantities among the limestone rocks at other places. In the parish of Abstone, 7 miles from Bristol, the hills rise perpendicularly to the height of 200 feet and upwards, and consist of a series of beds of limestone and petrosilex, alternating with each other. Towards the west a vein of coral occurs, 14 inches thick, and another of lead (both formerly worked), with a mass of petrosilex on each side. The centre of the glen is occupied by a bed of linstone, nearly 600 yards broad, lying between two beds of petrosilex, all dipping to the

north-west, at an angle of 60 feet with the plane of the horizon. In this are embedded lead-ore, spathous iron-ore, and barytes. By the side of the road nearer to Bristol, under the surface of the red soil, there are sometimes found nodules containing beautiful quartz crystals, with calcareous dog-tooth spar. A very superior limestone is obtained in great abundance a few miles north of Bristol; and the limestone rocks of Clifton are capable of receiving a good polish. Pellucid quartz crystals, hexagonal and terminated by detached pyramids, are found in the crevices of the strata at Clifton; these crystals were formerly in considerable request under the name of Bristol diamonds. A good compact limestone is found in the Forest of Dean. Freestone of excellent quality is quarried on the hills, more particularly at Painswick. Blue clay stone for building is found at Aust Cliff, which is composed of two strata of clay, the upper of a blue, the lower of a red tinge resting upon a grey limestone rock; embedded in the lower stratum is a bed of gypsum which furnishes a plentiful supply for stuccoing, &c., to the masons of Bristol and Bath. Paving-stones and grits are obtained in the Forest. At Dursley a stratum of tophus occurs.

Agriculture.—The climate of Gloucestershire varies according to the elevation of the land. In the valleys, especially those which are sheltered on the north and east, the temperature is mild. On the Cotswold hills, the air is sharp and bracing, and as the progress of tillage has brought higher lands into cultivation, farm-houses have been built in situations which require a hardy race to bear the keenness of the air. The children who can be reared there are strong and healthy, but those who are born with delicate frames have little chance of life if not removed to a milder air.

The Vale of Gloucestershire is noted for the early maturity of every kind of agricultural produce, owing partly to the nature of the soil, but chiefly to the shelter afforded by the hills on the north and east. It is however subject to violent storms from the Atlantic, which sometimes sweep with great fury along the course of the valley.

In an agricultural point of view, Gloucestershire may be divided into the Cotswolds or hilly portion, the Vale, and the Forest including the Ryelands. The first district traverses the whole county from Chipping Campden to Bath, and is divided into the upper and lower Cotswold hills.

The vale runs from Stratford-upon-Avon to Bristol, and is divided into the vales of Evesham, Gloucester, and Berkeley. The Avon runs along the upper part of the vale, and the Severn in the lower. The Forest of Dean lies on the northern side of the Severn, extending to the river Wye, which bounds the county on that side. The Ryelands are a sandy district of the Forest, bordering on Worcestershire and Herefordshire. The soil on the Cotswolds is chiefly a calcareous sand, a few inches deep, resting on oolite, a calcareous freestone commonly called stonebrash. The poorest is only fit for sheep-pasture; but the feed is very sweet, and the sheep thrive well on it. Where it has been improved by cultivation, and by the repeated folding of sheep, it bears tolerable crops of oats and barley, and where there is an admixture of clay in the loam, even of wheat. The lower parts of the hills, and the valleys which are between them, contain a better and deeper soil, evidently made by the washing down of the soil from the hills. Where the subsoil is impervious, the water is apt to accumulate; but by judicious draining some excellent arable and grass-land is produced. The dairies in these situations are productive; and the cheese made there is similar to the North Wiltshire. Some parts of the Vale contain a very deep and rich soil, as at Welford and its immediate neighbourhood. The soil there is a fine black loam; to the south the soil is heavier, but still rich, and produces great crops of wheat and beans. There is also a red loam of a very rich quality, evidently the deposit left by the overflowings of the rivers. At a greater distance from the rivers up to the foot of the hills, the soil is chiefly of a tenacious nature, which produces abundantly, when well drained and cultivated. Siliceous sand and gravel are found in a few spots, but not in sufficient quantity to form any considerable portion of the soil of the county, except in the Forest, where the soil is chiefly a decomposed red sandstone, very barren, and scarcely fitted for the growth of anything but woods and coppice.

The cultivation of the soil varies according to its nature and fertility; and although very considerable improvements have been introduced of late years, the system generally adopted is that which has been prevalent throughout the interior of England for nearly a century past. The Bath and West of England Society, and the exertions of several public-spirited proprietors, have introduced improved methods and instruments; but they have only been slowly and very partially adopted. Two or three crops and a fallow are still the prevalent rotations on all the heavier lands. Turnips have been long the substitute for fallows on the lighter soils; and the advantage of this useful root, as food for sheep in winter, is fully appreciated where many flocks are kept on the hills in summer. On the best managed light-land farms, the rotation is—1, turnips; 2, barley; 3, clover and grass mown; 4, the same fed with sheep and cattle; 5, wheat; 6, oats, vetches, or peas. The oats are sometimes succeeded by saintfoin, the seed of which has been sown amongst them. This saintfoin remains seven years before it is broken up.

In the rich heavy lands the rotation is fallow, wheat, beans, wheat.—On good light loam, 1, turnips; 2, barley; 3, grass mown; 4, ditto fed; 5, wheat. In most soils the wheat is not so good nor so free from weeds when the ground is broken up from a second year's grass, as it is after the first year; but the advantage of a fresh pasture, without additional expense of tillage, induces the farmer to let his clover and grasses remain two years on the ground. Experience has shown that, except in very rich soils, this is not the most profitable course.

In the thin light soils of the Cotswolds, wheat is not very productive; but the value of this grain induces the farmer to sow it, where oats would often be more profitable, from the greater certainty of the crop. The Cotswold land is injured by too much stirring; it is therefore ploughed with a very shallow furrow, or only *ribbled*, which is done by leaving a solid portion between every two furrows. The land is afterwards scuffled, or torn to pieces by an instrument with many teeth like a scarifier, which destroys the weeds and gives a sufficient tillage for sowing the wheat. The sheep, which have been folded on the land before the seed was sown, are repeatedly driven over the fields after the wheat is up, that their tread may give firmness to the ground, and prevent the wheat from being thrown out by the frost.

The broad-cast mode of sowing is almost universal. The few proprietors and farmers who use drills form an exception to the general practice. Very few have tried the setting or dibbling of wheat, which is so common in Essex, Suffolk, and Norfolk. The only crop which is dibbled or set is beans. They are planted in rows ten inches or a foot apart, in a direction across the ridges, which makes the process of hoeing more effective. In order to keep the rows straight and at equal distances, the dibblers stretch two lines, which are moved as soon as the beans have been planted along them; a bush-harrow drawn over the land fills the holes made by the dibble, and covers the seed. They are generally hoed twice: the first time, as soon as the beans are fairly out of the ground and show four leaves; the second, when they are about a foot high; a practice which greatly assists the growth. The hoeing is all done by hand, the horse-hoe not being much known in this country. Both winter and spring vetches are sown in considerable quantities for sheep food; among the first some rye is usually sown, and oats among the latter; these tend to support the stalk of the vetches, and keep them from the ground. This crop is not only very useful by supplying food for cattle and sheep at a time when green food is scarce, but by the closeness of its growth cleans the land effectually, choking all the annual weeds which may have come up.

Turnips are usually sown broad-cast, and hoed twice. They are fed off by sheep folded on them. A ton of hay per acre is given to the sheep while they feed on turnips; a very excellent practice where hay is not too valuable, by which the ewes are kept in good condition for yeaning, and the lambs are strong and healthy when they fall.

In the rye-lands, which are peculiarly adapted to the growth of turnips, an early quick-growing sort is frequently sown in July, and taken off in time for sowing wheat after it; this is exactly the Flemish practice, by which a good crop of turnips may be raised between the reaping of the rye and the sowing of the wheat. In the rye-lands this is not exactly the case, for the turnips are usually sown on a fallow, but in some places the clover, after having been fed off the second year till Midsummer, is ploughed up, and quick-growing turnips are sown immediately. The turnips come off in September, and leave the land in good condi-

tion for sowing wheat. They may also be sown after winter tares have been fed off, and in either case the most would be made of the land in one year. Rye was at one time the chief produce in the sandy soil, which has taken its name from this crop; but it has been found that wheat may be raised on these lands by means of lime and marl, and careful cultivation. It has therefore very generally superseded the rye, which is now chiefly sown for early sheep feed. Two bushels of rye are sufficient to sow on an acre if the crop is to be reaped; for green food three bushels are usually sown.

Flax was formerly cultivated to some extent in the Vale, but the belief that it was a very scourging crop, and returned nothing to the land, has led to the general prohibition of it in leases. Injudiciously managed, it is no doubt a crop which much diminishes the fertility of the soil; but with proper precautions it might not only be sown to advantage, but enter into the regular rotations, as in Flanders. [FLAX.]

Potatoes are raised in the rich light loams in considerable quantities. They are usually planted by dropping the sets after the plough in every second or third furrow. Twenty bushels thus set and moulded up with the plough will produce 300 or more. They are chiefly cultivated in the neighbourhood of the towns, and seldom consumed on the farm, but the manure purchased in the towns makes up for the exhaustion produced by this crop. In a county of which the greatest part of the subsoil is calcareous, saintfoin is a most valuable production; it grows in poor chalky soils and remains in vigour for many years. If the soil has been well prepared before the seed is sown, saintfoin is perhaps the most profitable crop which can be raised: after the first year it costs only the mowing and making into hay, and this hay is only surpassed in nutritive qualities by the best clover.

Teasels (*Dipsacus fullonum*) are raised for the use of the manufacturers of woollen cloth; but not to such an extent as they were once. They are a very profitable crop when they succeed, but precarious both in produce and in value. Old pastures broken up are the most suitable to this crop. The sward is simply ploughed over, and the seed of the teasels sown and covered by a bush-arrow. Two or three pecks are sufficient for an acre. The teasels are sown in March, and cut in the second year, when they are sometimes worth from 30*l.* to 50*l.* per acre. The same ground will bear teasels for several successive years, if some seed is scattered in the vacant places where the plants have died. Gloucestershire contains grass-lands and meadows equal for richness to any in the kingdom. Some of these are on the banks of the Severn, Avon, and other rivers; others are upland meadows and rich cow pastures. Those which are capable of irrigation, or are periodically flooded, are mown every year, and the hay is generally sold to feed the horses of tradesmen or manufacturers, and is also sent by water in considerable quantities to the Welsh collieries.

The meadows on the Ledden are particularly fertile, from the rich soil which this river brings down from Herefordshire; but they are also subject to sudden floods in summer, by which the whole crop is sometimes spoiled or swept away. The rich upland meadows contain the best grasses, such as the *Anthoxanthum odoratum*, *Trifolium repens*, *Lathyrus pratensis*, and *Festuca pratensis*, which are all well known as indicating the richest natural pastures. These meadows are usually pastured and mown in alternate years, if they are not kept altogether for pasturing cows and feeding oxen, which is generally the surest method to obtain a certain and regular profit from them. When the same meadows are mown repeatedly, they are manured with dung mixed with scrapings of roads, ashes, and the sweepings of streets, where they can be procured. This is the case chiefly in the dairy farms, where the old pastures are kept untouched for the cows, that the cheese may maintain its reputation. The land which has been manured and mown is kept for the horses and dry cattle only.

Gloucestershire is essentially a dairy country, and has been always renowned for its butter and cheese, of which great quantities are made and sold in every part of the kingdom. London alone consumes a large proportion of it. [BUTTER; CHEESE.]

The Gloucester breed of cows, although now eclipsed in public estimation by the improved short-horns and the Devon, has qualities which make them still be favourites with many experienced dairymen. Their colour is generally a dark red or brown, with a white stripe along the back, or at least on the rump, extending to the tail. A cross between this breed and the long-horned is preferred by some, while others assert the superiority of the pure long-horned stock, improved by Bakewell and Fowler. The Durham short-horned breed of cows is however gaining ground for the dairy, as the active Devon oxen are for the plough. On rich pastures the large Herefordshire oxen fatten to the greatest weight at an early age; but in this last respect the best breeds of short-horns have a decided superiority in the opinion of many experienced farmers.

The produce of a good cow should average from 3½ to 4½ cwt. of cheese in the year, or from 12 to 18 quarts of milk per day. Some very good cows will give 24 quarts every day, at two milkings, for seven months after calving; but the pasture must be rich and abundant. After this the quantity diminishes rapidly till within six weeks of her calving again, when she is no longer milked. The profit on a dairy of 20 cows, kept on 40 acres of rich pasture, is calculated in the excellent 'Agricultural View of Gloucestershire,' by Mr. Rudge, at 136*l.* 10*s.* per annum. The price of the cows he states at 400*l.*, which is 20*l.* each; a high price, which implies a very select stock. The cost of the requisite utensils of the dairy is only 23*l.* 16*s.* 4*d.*

The sheep peculiar to this county are the Cotswold and the Ryeland breeds. The first are large in the carcase, and rather strong in the bone, and the wool is coarse. At three years old a Cotswold sheep will weigh from 22lbs. to 30lbs. per quarter, and give 9lbs. or 10lbs. of wool per fleece. This breed has been successfully crossed with the improved Leicester, and also with the South-Down, in both cases with decided advantage; so that the pure original breed is scarcely to be met with. The improved cross with the South-Down is now in considerable repute with some, while others cry it down, and prefer the mixture of the Leicester blood; as both crosses have their supporters, it is probable that they may both be useful in particular situations. The Cotswold sheep will impart bulk both in flesh and wool; the Leicester increase the aptitude to fatten; and the South-Down improve the shape of the carcase and the quality of the wool. Careful and repeated experiments can alone decide which cross may be the best. The Ryeland, or Herefordshire sheep, are bred in the Forest district already mentioned. They are small in size, but larger than the common Forest sheep, weighing from 12lbs. to 14lbs. per quarter at three years old. They have white faces and no horns; the wool is very fine; and when they are fattened the flesh is of a very delicate flavour. This breed has been improved in size by crossing with the Leicester and black-faced Shropshire breeds, but always at the expense of fineness in the wool and flavour in the mutton. When crossed with the Merino, the Ryeland sheep produce a wool which bears a good price. This breed is perhaps the best to produce crosses with the Spanish, when the fineness of the wool is the principal object.

There are not many horses bred in this county, although they are generally preferred to oxen for the purposes of husbandry. The chief supply comes from the northern counties.

There are fine orchards in different parts of the Vale and Forest districts, and some very good cider and perry are made in the county.

The Forest of Dean antiently contained much valuable timber, chiefly chestnut, oak, and beech. It has been gradually much denuded of trees; so that there are large tracts of land entirely bare.

There are in the Forest, and dispersed through the county, many productive coppices, which are cut every ten, twelve, or fifteen years, and give good returns on land which is scarcely fit for any other purpose, or which would require a great outlay to bring it into cultivation. Many wastes, commons, and common-fields have been inclosed and improved, and there is not much land uncultivated which would give any adequate return for the expense of tillage. Much of the Vale land and some the Forest might be rendered more productive by the application of draining, liming, trenching, and other modes of improving land, which experience founded on national experiments has introduced into other parts of the kingdom. Many cold wet bottoms might be made sound pasture by a good system of draining; and many pastures, of little value in their present state, might be improved by judicious tillage and cropping, and then restored to the state of permanent grass, if it appeared best adapted to that purpose. Although many improve-

ments have been made of late years, there is still ample room for more, and the soil of this county might be made to produce a greater supply of food, both animal and vegetable, than it does at present.

The principal fairs in Gloucestershire are:—at Barton Regis, adjoining Gloucester, September 28; Berkeley, May 14; Bisley, May 4, November 12; Blakeney, May 12, November 12; Campden, Ash-Wednesday, April 25, August 5, December 11; Cirencester, Easter Tuesday, July 18, November 8; Cheltenham, second Thursday in April, Holy-Thursday, August 5, second Thursday in September, third Thursday in December; Coleford, June 20, last Friday in August, December 5; Dursley, May 6, December 4; Fairford, May 11, November 12; Frampton-upon-Severn, last Tuesday in June; Gloucester, April 5, July 5, September 28, November 28; Hampton, Trinity-Monday, October 29; Lechlade, August 5, 21, September 9; Lidney, May 4, November 8; Marshfield, May 24, October 24; Mitchel-Dean, Easter-Monday, October 11; Newnham, June 11, October 18; Newent, Wednesday before Easter, Wednesday before Whit-Sunday, August 13, Friday after September 18; North Leach, Wednesday before May 4, last Wednesday in May, first Wednesday in September, Wednesday before October 11; Painswick, Whit-Tuesday, September 19; Stonehouse, May 1, October 11, November 10; Stow on the Wold, May 12; Stroud, May 12, August 21; Tetbury, Ash-Wednesday, Wednesday before and after April 5, July 22; Tewkesbury, March 11, May 14, June 22, September 4, October 11; Thornbury, Easter-Monday, August 15; Wickwar, April 5, July 2; Winchcomb, last Saturday in March, May 6, July 28; Wotton-under-Edge, September 25.

Divisions, Towns, &c.—Gloucestershire is divided into twenty-eight hundreds, containing 351 parishes, one city, and part of another, and twenty-eight market-towns. The hundreds are as follow:—Berkeley, Bisley, Blidesloe, Botloe, Bradley, Briavel's, St., Brightwells-Barrow, Cheltenham, Cleeve, Crowthorne and Minety, Deerhurst, Dudstone and King's Barton, Grumbald's Ash, Henbury, Kiftsgate, Lancaster, Langley and Swinehead, Longtree, Puckle Church, Rapsgate, Slaughter, Tewkesbury, Thornbury, Tibaldstone, Westbury, Westminster, Whitstone, Bristol, with Barton Regis, Gloucester (city and county).

The market-towns, excluding Gloucester, are—Berkeley, Bisley, Chipping Campden, Cheltenham, Cirencester, Coleford, Dursley, Fairford, Lechlade, Marshfield, Minchinhampton, Mitcheldean, Moreton-in-the-Marsh, Newent, Newnham, Northleach, Painswick, Sadbury, Stanley St. Leonard, Stow-on-the-Wold, Stroud, Tetbury, Tewkesbury, Thornbury, Wickwar, Winchcomb, and Wotton-under-Edge. Those of sufficient consequence are noticed under their respective heads. [Berkeley; Bristol; Cheltenham; Cirencester; Gloucester; Stroud; Tetbury; and Tewkesbury.] A short account is subjoined of the less important towns.

Minchinhampton, 12 miles south-south-east of Gloucester, is an irregularly built market-town, pleasantly situated on a gentle declivity. It consists of four streets, lying at right angles to each other, and contained, in 1831, 1116 houses. There are three market-houses, two of which were erected in 1700, by Mr. P. Sheppard, with the design of establishing a wool-market, but the attempt was unsuccessful. The cloth manufacture is carried on to a considerable extent along the banks of the numerous brooks and rivulets in the vicinity. This town is in the Stroud or great clothing district, about four miles south-east of the town of Stroud. The church, founded about the reign of Henry III., by the nuns of Caen, is built in the form of a cross, with side aisles, &c. The south transept was rebuilt in 1382, by Sir John de la Mere. There are numerous monuments in the interior of the church.

Minchinhampton contains a tolerably well endowed free-school, and two other charitable schools. Amberley, a large tract of common land on the west side of the town, containing about 1000 acres, was given for the use of the poor resident inhabitants of the parish by dame Alice Hampton, in the reign of Henry VIII. This common is the site of a remarkable encampment, supposed to have been made by the Danes during their occupation of Cirencester in 879. Commencing at Littleworth, the traces of the encampment extend nearly three miles to Woeful Dane Bottom, a name no doubt given to the spot in commemoration of some disastrous defeat of the Danes, but no other record of the event is left. A smaller encampment, skirting the brow of Nailsworth Hill, meets this at its eastern extremity. The population of the parish of Minchinhampton in 1831 was 7255.

Painswick is in the same district, about three miles north of Stroud, and five miles and a half south-south-east of Gloucester. It is small and irregularly built on the southern acclivity of Sponebed Hill. The church is an antient building, with a tower and spire rising to the height of 174 feet. The population of the parish in 1831 was 4099; most of the inhabitants are employed in the clothing manufacture. On the summit of Sponebed Hill is an antient fortification, called Kinsbury Castle. Roman coins and other antiquities have been found here; and it is supposed to have been once a place of great strength.

Bisley is another small town in the same district, about three miles east of Stroud. The church, which is antient, contains numerous monuments. A common, containing 1200 acres, was given to the poor of Bisley, by Roger Mortimer, earl of March, in the reign of Edward III.; since that period this space has been much lessened by enclosure. The cloth manufacture is extensively carried on in this parish, which in 1831 contained 5896 inhabitants.

Dursley, 14 miles south-south-west of Gloucester, is a small irregularly built town, consisting of two streets intersecting each other, and is situated at the base of a steep hill, covered with a fine hanging wood of beech. Some of the houses are of considerable antiquity; on the exterior of one of them is the date of 1520. The church is a large handsome building; near the centre of the town is a neat market-house of freestone, erected in 1738. The clothing business seems to have been carried on here for a very long time, for Leland calls Dursley 'a praty clothinge towne.' There are now six clothing-mills in the vicinity. The population of the parish in 1831 was 3226. In the neighbourhood there occurs a stratum of tophus, or puff-stone, which when first cut is so soft as to be worked with the greatest facility, but after exposure to the air it becomes extremely hard and durable. The walls of Berkeley Castle are composed of this stone, and, though built more than 700 years back, are still in a good state of preservation.

Wotton-under-Edge, 18 miles south by west of Gloucester, is a respectable old town, situated near the base of a ridge of wooded hills, whence it derives its name. The old town was burnt down in the reign of king John: a place called the Brands is supposed to mark its original site. The present town is well built, and contains a handsome old church, in which there are many curious monuments. There is a well-endowed free-school, and three hospitals, with other charities. Wotton also is one of the clothing towns, and has many clothing-mills. Its trade is at present in a flourishing state. Its population in 1831 was 5482, and the parish then contained 1166 houses. The Berkeley Avon, a small river which falls into the Severn, near Berkeley, runs by this town. Wotton and Dursley are polling-places for the county.

At Kingswood, one mile south of Wotton, there are seven clothing-mills, one of which is among the largest in the county. This place is situated in the small detached piece of Wiltshire which is in Gloucestershire. Here are the remains of an abbey of Cistercian monks, founded in 1139 by William de Berkeley.

Thornbury, a borough and market-town about two miles from the Severn, and 21½ miles south-south-west of Gloucester, principally consists of three streets, disposed in the form of the letter Y, 'having first one longe strete,' says Leland, 'and two hornes goyne out of it.' The buildings are in general old; the church is a large handsome structure, surmounted by a lofty tower ornamented with rich open-worked battlements and eight pinnacles.

The town has two free-schools and several charities. At the end of the town are the ruins of the unfinished palatial castle of Thornbury, begun by Edward Stafford, duke of Buckingham, but left incomplete when he was beheaded in 1522. Even in its present dilapidated state it shows the magnificence of its design, and is a good specimen of the last gradation of Gothic architecture, in the application of that style to castellated houses. The whole, when completed, was to have formed a quadrangle inclosing an area of two acres and a half. Leland describes it as having the principal front towards the west nearly finished, and another towards the south completely so. From a survey made in 1582, it appears that the whole of this latter side, con-

sisting of several chambers of fine dimensions, was then habitable. In the reign of Elizabeth the principal timbers were taken away, and time has since continued the work of ruin. Within the circuit walls twelve acres were inclosed; around the walls were attached small rooms intended as barracks for soldiers. This circumstance, it is said, roused the jealousy of the king, and confirmed him in his suspicions of the duke's traitorous intentions. The population of the parish of Thornbury in 1831 was 4375, and it contained 833 houses.

Wickwar, 20 miles south-by-west of Gloucester, is an antient market-town of small dimensions. It is well watered by two small streams which run through the town, over one of which there is a handsome stone bridge. The church is large, and has a lofty tower. There is a well-endowed free-school. The parish contains 193 houses and 972 inhabitants. Wickwar derives its name from Wick, a turn in a stream, and War, from the manor having belonged to the family of De la Warre.

Chipping Sodbury, 24 miles south-south-west of Gloucester, is an antient market-town, standing in a bottom; it consists of several streets, is a great thoroughfare on the road from Bristol to Cirencester and Oxfordshire, and has very good inns. There is a large church with a lofty tower, though it is only a chapel-of-ease to Old Sodbury, a village in its neighbourhood. Sodbury contains a free grammar-school, with other benevolent institutions. This town was formerly one of the greatest markets for cheese in the kingdom. Its population in 1831 was 1306, and there were then 236 houses. Sodbury and Thornbury are polling places for the county.

Marshfield, a small market-town 28 miles south of Gloucester, is situated on the borders of the county, just at its junction with Wiltshire and Somersetshire. Near the town, at a place called the Rocks, are three shire stones to mark the limits of the three counties where they meet in a point. Marshfield is composed chiefly of one street of old buildings, nearly a mile long; it is a clothing town; a considerable quantity of malt is likewise made here for the supply of the Bath and Bristol brewers. There is a good charity school and a well-endowed almshouse for eight poor people. The population in 1831 was 1651, and the number of houses 311.

Lechlade, 27 miles east-south-east of Gloucester, is situated near the point where the four counties of Gloucestershire, Wiltshire, Oxfordshire, and Berkshire, have their junction, and near a small affluent of the Thames, called the Lech. Here commences the Thames and Severn canal, and the Thames first becomes navigable for barges of 70 or 80 tons burden. In consequence of these favourable circumstances the place has much traffic in the produce of the country and in London goods. The church is a handsome building in the pointed style; the pulpit is of sculptured stone. Several years back a subterraneous building was discovered near the town, about 50 feet in length, 40 in breadth, and 4 in height, supported by pillars of brick, and curiously inlaid with variegated stones; it is supposed to have been a Roman bath. The population of Lechlade in 1831 was 1244, houses 249.

Fairford, four miles from Lechlade and 23 miles east-south-east of Gloucester, is pleasantly situated on the banks of the Colne; the town consists of two streets neatly and regularly built. It has a free school with an endowment of 130*l.* per annum., and several charities. Fairford is celebrated for the beauty of its church, which was built in the reign of Henry VII., and owes its origin to the following accidental circumstance:—John Tame, a merchant of London, came into possession of a captured vessel which was bound to Rome, and in which there was a large quantity of curious painted glass. He determined to erect a building to receive this glass, and selected for the spot Fairford, which had been his place of residence for some time. Having purchased the manor of Henry VII., he commenced the church in 1493, but dying soon afterwards it was completed by his son. The glass was disposed in 28 windows with four or more compartments in each; but in several of them the figures are now mutilated or displaced. Some of the most striking passages in the Old and New Testament form the subjects of the paintings, which are considered extremely beautiful specimens of the art; they were designed by Albert Durer, to whom the greatest improvements in the art of painting on glass are attributed. In course of time and during the civil wars, these windows suffered some mutilation; but to secure them from further injury, in 1725 a lattice of wire was fitted to each window. The population of Fairford in 1831 was 1574, the number of houses 317.

North Leach, 16½ miles east by south of Gloucester, is a small market-town, lying in a bottom among the Cotswold Hills, near the source of the Lech; it principally consists of one long irregularly-built street. The church is a large handsome building, with an elegant south porch and a lofty tower at the west end. In 1558 a free grammar-school was founded here by Hugh Westwood. The market-house is an old building supported on columns. Three centuries back North Leach was important as a clothing town; but not having sufficient supply of water to answer the demands of an increasing manufacture, this was gradually removed to more favourable situations. The number of inhabitants in 1831 was 795, and of houses 126. North Leach is a polling place for the county.

Winchcomb, a market-town 14 miles north-east of Gloucester, is beautifully situated at the base of several hills, having the little river Isbourne, an affluent of the Upper Avon, flowing through it. This place is of great antiquity, and was once of considerable importance; being antiently the site of a castle and of a mitred abbey sufficiently large for the accommodation of 300 Benedictine monks. Every trace of these buildings has been long destroyed. The town at present principally consists of two streets intersecting each other; the houses are mostly low and are built of stone. The church is a fine Gothic building, with an embattled tower at the west end, opening by an arch into the nave; part of it was built in the reign of Henry VI., by the abbot William Winchcomb. The workhouse is an old irregular building. There is an endowed grammar-school, three charity schools, and an almshouse. It is said that Winchcomb was the first place where tobacco was grown in this country, and, before the cultivation to any extent was prohibited in England, it was noted for its plantations. The number of inhabitants in 1831 was 2514, and the number of houses 539.

Stow-on-the-Wold, a market-town 23 miles east-north-east of Gloucester, is situated on the summit of a high bleak hill, the base of which is about three miles in diameter. The town is irregularly built, and the houses, which are built of stone, are in general low. The church is a substantial building erected during the fourteenth and fifteenth centuries. The shoe manufactory is carried on here to some extent. There is a free grammar-school, an alms house, and several charities. Owing to the great elevation of the town the inhabitants have a very inadequate supply of water. The population in 1831 was 1810, and the number of houses 271.

Moreton-in-the-Marsh, is a small market-town 24½ miles east-north-east of Gloucester, occupying a low situation on the Roman Foss-way, about two miles west from the Four-shire-stone, an ornamental pillar which marks the point of junction between Gloucestershire, Oxfordshire, Warwickshire, and a detached part of Worcestershire. The market has been long disused; an old building, once the market-house, supported on pillars, stands in the middle of the village. The number of inhabitants in 1831 was 1331, and of houses 254.

Chipping (market) Campden, 24 miles north-east of Gloucester, near the confines of Worcestershire, is a very antient market-town and borough, situated in a fertile valley surrounded by cultivated hills partially covered with woods. There are records so early as 687 of this place, when the Saxon kings assembled here to consult on the mode of carrying on the war with the Britons. In the fourteenth century this town became the principal mart for wool, and the residence of many opulent merchants; but as the wool trade became more generally diffused Campden gradually declined, and both the manufacturers and merchandise of early days are now totally lost. The church stands on a gentle declivity above the town, in the hamlet of Berrington; it is a very handsome antient structure, having an ornamented tower at the west end, 120 feet high; at the east end of each aisle is a chapel. It is probable that this church owed its erection to the munificence of the wool merchants, several of whom are interred here, with brass effigies and memorials. In the chapel in the south aisle there are some very fine marble monuments. Campden has an hospital and several other institutions founded by Sir Baptiste Hicks, early in the seventeenth century. The population of the

place in 1831 was 2038, the number of houses was 419. Campden is one of the polling places for the eastern division of the county.

Newent, eight miles north-west of Gloucester, is a small irregularly-built market-town, situated in the Forest of Dean. It was formerly of more consequence than at present. The court-house was built on the site of an alien priory, supposed to have been founded soon after the Norman invasion; an antient gateway and some smaller fragments of monastic buildings yet remain. The church is an antient building of various architecture, apparently having been three times partially rebuilt. Coal abounds in the vicinity, and several pits have been sunk here. The Hereford canal passes by this town. In 1831 the population was 2859, and the number of houses 518.

Newent is a polling-place for the western division of the county.

Mitcheldean, a small market-town, situated in a deep dell in the Forest of Dean, 10 miles west of Gloucester, has a church of some antiquity, with a roof of oak timber finely carved. A subterraneous passage, concerning which many curious stories are told, leads from the church to a wood upon a hill about half a mile from the town. The population of the parish in 1831 was 601; the number of houses 150.

Newnham, 9½ miles south-west of Gloucester, stands on an eminence rising from the western banks of the Severn, which is here nearly a mile across at high-water. There is a ferry established at this place. Newnham is of great antiquity. In the Norman times it appears to have been a fortified town designed to repress the incursions of the Welsh; and in antient records mention is often made of the castle here. The former consequence of the town may be inferred from many names of lanes and streets which appear in antient grants, but the situations of which are now forgotten. The houses are now principally ranged in one long street, and the church stands on a cliff near the river. In the middle of the last century a quay for vessels of 150 tons burthen was built here by one of the Pyrke family; and some trade is now carried on with Bristol and London, and other parts. The population of the town in 1831 was 1074; the number of houses 184.

Coleford, 14½ miles west-by-south of Gloucester, and in the parish of Newland, is a small market-town, consisting principally of one street: the houses are in general well built. This town suffered much in the civil wars. The chapel, which was then destroyed, was rebuilt in the reign of Queen Anne. The number of inhabitants in 1831 was 2193; the number of houses 422.

St. Briavel's, 19 miles south-west of Gloucester, was once a borough and market-town, the inhabitants of which had many rights and exemptions, one of which was freedom from all toll throughout the kingdom. The town is now become a small village, and its privileges are obsolete; the parochial inhabitants have however still the right of common in a wood called Hudnells, which includes a tract of land on the banks of the Wye, about six miles long and one mile broad. They have also the privilege of cutting wood, but not timber, in other parts of the forest. These claims were set aside by Cromwell, but were contested and allowed after the Restoration. St. Briavel's castle was erected in the reign of Henry I. by Milo Fitz-Walter, earl of Hereford, to curb the incursions of the Welsh; it was afterwards forfeited to the crown, by whom its constables have ever since been appointed. The site of the castle is surrounded by a moat, including an area of considerable extent. The north-west front is nearly all that remains entire. It is composed of two circular towers three stories high, separated by a narrow elliptical gateway; within the towers are several hexagonal apartments, the walls of which are eight feet thick. One of these towers is used as a prison for the hundred. In the interior there are two gateways similar to the former. On the right are the remains of an apartment, 40 feet by 20, with large pointed windows; and on the left are the remains of a large hall. In the centre is a low building, which serves as an antechamber to the room in which the officers of the hundred hold their court. The constable of the castle is appointed by the crown, and is also the lord-warden of the forest.

Ecclesiastical and Legal Jurisdiction.—The whole county, with the exceptions of the chapelries of Icomb and Cowpony-horse, is included within the diocese of Gloucester and Bristol, which comprehends one archdeaconry and ten deaneries. Gloucestershire is included in the Oxford circuit.

Till very lately, Gloucester and Bristol were two separate dioceses; they are now formed into one. Before this union, 38 parishes in this county were included in the diocese of Bristol, and the remainder were in the diocese of Gloucester.

Gloucestershire, before the Reform Act, was represented by two members in parliament. It is now formed into two divisions, eastern and western, each of which sends two members to parliament. The western division comprehends all that part of the county west of the Severn, except a small piece of Deerhurst Hundred above Gloucester, and that part on the east of the Severn below Frampton: its boundary line extends from that place to the eastern limit of the county about 2½ miles nearly west of Malmesbury, including 12 hundreds in this division; the remaining hundreds belong to the eastern division.

The boroughs of Gloucester, Stroud, Cirencester, and Tewkesbury, each return two members to parliament, and the borough of Cheltenham one member. The places of election for the western and eastern divisions respectively are Dursley and Gloucester.

Manufactures.—These are numerous and important. The cloth manufacture is extensively carried on at Wotton-under-Edge, Stroud, Minchinhampton, Bisley, Uley, Norsley, Cam, Painswick, Rodborough, and King's Stanley. At Frampton Cotterell, Winterbourn, Bitton, and Westerleigh, there are considerable hat and felt manufactories, and some persons are also engaged in stocking-making. The last-mentioned manufacture is extensively pursued at Tewkesbury, where frame-making likewise gives employment to some of the inhabitants; some of them are likewise engaged in lace making. In Gloucester and in the suburbs of Bristol there are pin manufactories. At Newland and English Bicknor tin-plates are made. Edge-tools are made at Cooley: and glass-bottles in the suburbs of Bristol. At Moreton and a few other places cheese cloths and other articles of linen are made. The large commercial city of Bristol has also several manufactories, and works in brass, iron, floorcloths, lace, hats, soap, vinegar, &c.

Civil History and Antiquities.—The inhabitants of the most part of Gloucestershire and of Oxfordshire were, at the time of the Roman invasion, distinguished by the name of Dobuni. [BRITANNIA.]

It appears that the Dobuni were subject to their neighbours the Catteuchlani before they were conquered by the Romans, about A.D. 45, when they submitted to Aulus Plautius, the Propraetor, who placed garrisons among them, and it is supposed that soon after that time the district now called Gloucestershire was made a barrier country, and defended against the incursions of the Silures by a chain of forts. On the division of the island into Britannia Prima and Secunda, that part of Gloucestershire which lies south-east of the Severn was included in the former province: the other part in the latter. After the subsequent division made under Constantine, the county, or the greater part of it, was included in the province named Flavia Caesariensis. From the ruins which have been at different times discovered in various parts of the county, it was evidently much occupied by the Romans. Cirencester was the great metropolis, while Gloucester and the hills about the Severn were the great military positions. Gloucestershire formed part of the Mercian kingdom under the Saxon dynasty, and Winchcomb and King-Stanley are mentioned as residences of the Anglo-Saxon monarchs. On the division of Mercia into five bishoprics, after the conversion of the Saxons, the greatest part of this county was included under that named Wiccia, a word of doubtful etymology.

It is not known when the county obtained its present name, but it appears that Wiccia and Glewancester-scira were both used about the same period. Under the Saxon kings it was much harassed by the Danes, and during the civil wars between Queen Maude and Stephen, it also greatly suffered. The Welsh disturbed the peace of the county with many incursions during the reign of Henry II.; and in the Barons' War the inhabitants took the side of the barons. In the contests between the houses of York and Lancaster it likewise became the scene of warfare; the result of the battle of Tewkesbury, fought at that time, is well known. In the civil wars of a later period, between the parliament and the crown, Gloucestershire is also conspicuous in the history of our country: many struggles be-

tween the rival forces took place in different parts of this county.

The principal Roman roads in the county are the Foss-way, Ermine-street, Ikenild-street, and the Via Julia. The Foss-way enters Gloucestershire at Leamington, proceeds through Moreton-in-Marsh, to Stow-on-the-Wold; passes on to Northleach, leaving Bourton-on-the-Water about half a mile to the east; then crossing the Calne at Foss-bridge, it joins Ikenild-street about a mile north-east of Cirencester, at which place it crosses Ermine-street, and after a few miles passes into Wiltshire. Ermine-street enters the county at Latton, near Cricklade, passes through Cirencester, over Birdlip hill, to Gloucester, and thence proceeds through the western part of the county into Monmouthshire. Ikenild-street crosses Oxfordshire, and entering Gloucestershire at Eastleach, proceeds to Cirencester, and then to Aust—the Trajectus Augusta of the Romans. The Via Julia led from Bath across the Severn into Monmouthshire, whence its course was continued through Glamorganshire to Caermarthenshire and St. David's.

There are several traces of Roman camps in this county. One of these occurs a short distance from the Foss-way, near the village of Bourton-on-the-Water; it is quadrangular, inclosing about sixty acres, and on one side a paved aqueduct has been found. Numerous coins and other vestiges of the Romans have been discovered on this spot. Among these was a curious gold signet, weighing nearly an ounce, having the representation of a Roman soldier, sitting on a tripod, with a spear in his left hand, and the Roman eagle at his feet. In the parish of South Cerney, about three miles south of Cirencester, the imperfect vestiges of a Roman specula, or outpost, with circumvallations, can be traced. On two hills of considerable elevation, near Sydney Park, are traces of two antient camps, or forts, overlooking the Severn. Near the western edge of the larger are the remains of a Roman bath, of an elliptic form, about three yards in length. Various foundations of Roman buildings and other antiquities have also been found near this place. In the vicinity of Sapperton are vestiges of an antient camp, and in the same parish, near the hamlet of Frampton, numerous silver and brass Roman coins of the Lower Empire were accidentally discovered in 1759, by a waggon passing over the spot where they had been buried, and breaking the urns which contained them. On the hill north-west of the village of Uley is an antient Roman work called Uley Bury Camp; various coins, chiefly of the emperors Antoninus and Constantine, have been found there. At Stanley a number of Roman antiquities has been found, and there are traces of a Roman camp.

At Chedworth a Roman bath was discovered in 1760; and at Combe-End, in the parish of Elkstone, about sixty years back the foundations of a Roman building and various antiquities were discovered. Several Roman coins have been found in and near Tetbury. But Woodchester, a small village about two miles and a half south-west of Stroud, is the most celebrated place in this county for the number and beauty of the Roman antiquities found there. A great tessellated pavement was discovered by the digging of graves in the church-yard of this village; it had been partially uncovered for many years, but it was not until 1793 that Lysons ascertained, by various openings which he caused to be made in the ground to the depth of about four feet, its complete design, form, and dimensions. It appears to have been a square of 48 feet 10 inches. Its general design is a circular area of 25 feet diameter, inclosed within a square frame consisting of twenty-four compartments, enriched with a great variety of guilloches, scrolls, frets, and other antique architectural ornaments, edged on the inside by a braided guilloche, and on the outside by a labyrinth fret. The large circular area is enclosed by a highly ornamented border, and immediately within this are representations of various beasts, originally twelve in number, and most of them about four feet in length; in an inner circle are figures of birds, and within this circle is an octagonal compartment, in which were representations of fish; no part of the central octagon is at present in existence, and some of the figures of the animals and birds are likewise mutilated or destroyed. For a more particular account of this pavement we refer the reader to 'Gloucestershire Antiquities,' by Lysons, who thinks it unquestionably superior to any thing of the same kind hitherto found in Britain. Various foundations of apartments with tessellated pavements of various patterns have been found at different periods within the church-yard and contiguous to the great pavement; the principal discoveries respecting these were made in 1795 and the following year, when the ground-plot of a very large Roman building was almost completely ascertained, extending from the church-yard to an adjoining orchard and a field. Several fragments of stucco painted in fresco were found among the rubbish, and considerable remains of two fire-places, with various flues connected to them, by which the building was heated. The remains of two hypocausts were also discovered within a little distance of each other; several fragments of statues, of red glazed pottery and of glass, various pieces of stags' horns, and numerous coins have been found amongst the ruins of the buildings.

There are many traces of British, Saxon, and Danish works in this county, as well as of Roman. At Beachley, a point of land formed by the confluence of the rivers Wye and Severn, extensive earth-works are still remaining, probably of British origin. Offa's dyke terminates here, and may be clearly traced crossing the road at Buttington Tump.

At Willersley, near Chipping Campden, on the summit of a hill, is an antient camp, about sixty acres in area, enclosed by banks in tolerable preservation. Another antient encampment occurs at Gravesend, about three miles nearly south of Thornbury, and near it an immense tumulus; and at a little distance is a small square camp, with a single ditch and vallum. On the ridge of hills called Cleeve Clouds, about three miles nearly north of Cheltenham, there are also many vestiges of military occupation; the extremity of the ridge is fortified by a deep vallum extending 300 yards in the form of a crescent; and on every side but the front inaccessible. Near Little Sodbury there is also an antient camp of a rectangular form, 320 yards long and 200 broad. In a field adjoining Gatcomb Park, near Minchin Hampton, is a large oval tumulus which formerly had large erect stones at each end. On the summit stands a large fragment of rock, known for ages by the name of Tingle Stone. In the common-field near it are two large stones set upright in the ground: tradition assigns these to the memory of Long, a Danish chieftain.

In Pen Park, in the parish of Westbury, there is a remarkable excavation, called Pen Park Hole. It is supposed to be an exhausted lead-mine, from an inspection made by Captain Sturmey in 1669, and by a subsequent one made by Captain Collins in 1682, an account of which is given in the 'Philosophical Transactions.' This cavity is very extensive, and has evidently been the work of human hands; it is about 250 feet deep, and the bottom is now usually covered with water, varying in depth according to the season of the year, from 20 to 75 feet.

There are several fine old family seats in this county, some of which are of very ancient date; and there are also ruins of castles and abbeys.

The ruins of Sudely castle, situated about a mile south-south-east of Winchcomb, are grand rather than strikingly picturesque. Leland celebrates its extent and lofty towers, its magnificence and rich architecture; and Fuller calls it, 'of subjects' castles, the most handsome habitation; and of subjects' habitations, the strongest castle.' It was built in the reign of Henry VI. by Ralph Lord Boteler, on the site of a more ancient castle, to the manor of which he succeeded in right of his mother Joan de Sudely. During the civil wars this castle was taken by the republican party, dismantled, and otherwise destroyed. The chapel attached to it, which was a light elegant erection, was stripped of its roof, and the memorials of the dead defaced. A small side chapel or aisle is now used as the parish church of Sudely.

Badmington House, the family residence of the Dukes of Beaufort, is about five miles and a half east by north from Chipping Sodbury. It was erected in 1682, on a very extensive scale, and is enriched by many original and beautiful paintings of the old masters. Barnsley Park, about four miles and a quarter east-north-east of Cirencester, is three miles in circumference: the mansion which it surrounds is a sumptuous edifice in the Italian style. The saloon is highly decorated with fresco painting. Barrington Hall, between five and six miles east of Northleach, is situated in a large well planted park, is a handsome edifice erected in 1734, by Lord Chancellor Talbot; it is a seat of Lord Dynevor. About four miles from Bristol, on a fine elevation, commanding beautiful views, stands Blaize Castle, a castellated mansion, built, it is supposed, on the site of a Roman specula; several Roman coins, and other antiqui-

ties, have been found on the spot. Highnam Court, well situated about two miles west-north-west of Gloucester, was built in the time of Cromwell; it stands in an extensive park, and contains a large collection of family portraits. Misenden Park, the property of the Sandys family, is seven miles in circumference, clothed with fine beech-wood, and of uneven surface; it affords most picturesque and beautiful scenery. In the midst of a deep valley is a circular mound, surrounded by a moat, which is the site of a castle built in the beginning of the thirteenth century. The present mansion is situated on an eminence in the park, and is said to have been built with the materials of the old castle, but the period is not known when the one was destroyed, and the other rose from its ruins; the present building has an appearance of antiquity; during the civil wars it was for a short time garrisoned for the parliament.

At a short distance west of Cirencester stands Oakley Grove, the seat of Earl Bathurst. The mansion was built early in the last century; it is spacious, built on the French plan, with a large hall in the centre, and rooms *en suite*. The rooms are embellished with many fine portraits and other paintings. The park and grounds are highly ornamental.

At Southam, two miles and a half north-east of Cheltenham, stands Southam House, mentioned by Leland as having been recently built by Sir John Huddlestone, at the time when he made his survey by command of Henry VIII. It is a venerable structure, and retains more of its original form than perhaps any other domestic building in England of that æra. It is constructed with two stories only, without a parapet; the three principal apartments appear to have been finished at first as they still remain; one of the halls is partly paved with glazed or painted tiles brought from Hayles Abbey.

(Fosbrooke's *History of Gloucestershire*; Rudge's *Tour*; *History of Fairford Church*; Lysons' *Gloucestershire, Antiquities*; Dugdale's *British Traveller*; *Beauties of England and Wales*; Conybeare and Philip's *Outlines of the Geology of England*.)

Statistics.

Population.—Gloucestershire is partly an agricultural and partly a manufacturing county. It ranks the thirty-third on the list of agricultural counties, and in this respect retains nearly the same position as it did in 1811, when it was the thirty-fourth on the list. Of 94,234 males, 20 years and upwards, living in this county in 1831, there were 26,448 engaged in agricultural pursuits; 18,322 employed as labourers in labour not agricultural; and 5,992 occupied in manufacture, or in making manufacturing machinery. Of this last number 4,500 were employed as clothiers, of whom between four and five hundred were at Wotton-under-Edge, nearly as many at Stroud, and also at Minchinhampton; between three and four hundred at Bisley, also at Ulley; between two and three hundred at Norsely, at Cam, at Painswick, at Rodborough, and at King's-Stanley. Upwards of 600 men are employed in making hats or felt at Frampton-Cotterell, Winterbourn and Bitton, and at Westerleigh, with which stocking-making is somewhat intermixed; but at Tewkesbury nearly 300 men may be distinctly ascribed to the last-named manufacture and frame-making; 44 to lace-making. Nearly 150 men are employed in making pins, chiefly in the city of Gloucester, and in the suburbs of Bristol, and several at Siston; upwards of 70 men in making tin-plates at Newland and English Bicknor; 50 in making edge-tools, chiefly at Cooley; as many in making glass bottles in the suburbs of Bristol; at Moreton and a few other places cheese-cloths and other articles of linen are made: add to all these the workers in brass and iron, makers of floorcloths, lace, hats, soap, vinegar, &c., in the large commercial city of Bristol.

The following table is a summary of the population, &c. of every hundred, as taken in 1831:—

Summary of the County of Gloucester

HUNDREDS, CITIES, or BOROUGHS.	HOUSES.				OCCUPATIONS.			PERSONS.			
	Inhabited.	Families	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males twenty years of age.
Berkeley, Hundred	5,196	5,618	30	496	1,565	2,719	1,334	13,160	13,688	26,848	6,327
Bisley	4,098	4,278	37	410	819	2,154	1,305	9,497	10,279	19,776	4,459
Blidesloe	541	594	1	16	223	184	187	1,461	1,484	2,945	761
Botloe	1,269	1,427	9	44	815	335	277	3,398	3,224	6,622	1,827
Bradley	999	1,098	2	31	693	238	167	2,778	2,538	5,316	1,427
Briavel's, St.	3,236	3,370	32	173	789	1,077	1,504	8,178	7,914	16,092	4,119
Brightwells-Barrow	1,506	1,576	9	33	929	387	260	3,582	3,577	7,159	1,786
Cheltenham	4,691	5,488	104	274	264	2,142	3,082	11,793	14,781	26,574	6,174
Cleeve	340	367	1	9	242	70	55	848	794	1,642	460
Crowthorne and Minety	1,219	1,327	5	41	948	211	168	2,899	2,867	5,766	1,477
Deerhurst	764	815	2	21	511	163	141	2,005	2,040	4,045	1,073
Dudstone and King's-Barton	2,218	2,444	6	86	1,366	664	414	6,022	6,309	12,331	3,009
Grumbalds-Ash	1,849	2,084	10	95	1,007	554	523	4,837	4,899	9,736	2,418
Henbury	1,316	1,448	15	51	553	477	418	3,603	4,006	7,609	1,512
Kiftsgate	3,092	3,342	24	111	2,154	702	486	7,658	7,429	15,087	3,854
Lancaster	440	500	3	10	340	91	69	1,221	1,135	2,356	641
Langley and Swinehead	3,369	3,534	40	117	1,021	1,235	1,278	8,713	8,715	17,428	4,213
Longtree	3,822	3,953	25	469	704	2,181	1,068	8,757	9,555	18,312	4,272
Puckle Church	908	953	5	19	258	217	478	2,348	2,276	4,624	1,191
Rapsgate	793	842	2	28	551	181	110	1,967	1,891	3,858	1,051
Slaughter	1,795	1,895	7	97	1,107	558	230	4,419	4,229	8,648	2,368
Tewkesbury	904	1,000	13	17	688	195	117	2,314	2,223	4,537	1,288
Thornbury	1,492	1,568	19	54	860	406	302	3,932	3,941	7,873	1,887
Tibaldstone	162	177	—	6	121	22	34	425	399	824	223
Westbury	1,158	1,228	6	36	665	256	307	2,969	3,033	6,002	1,574
Westminster, Hundred	830	881	2	23	531	230	120	2,102	2,038	4,140	1,069
Whitstone, Hundred	2,709	2,907	18	179	792	1,359	756	6,813	7,037	13,850	3,316
Bristol, City, with Barton-Regis, Hundred	16,145	23,616	332	1100	338	11,032	12,246	46,535	57,351	103,886	24,732
Gloucester, City	2,069	2,546	22	94	116	1,357	1,073	5,646	6,287	11,933	2,976
Cirencester, Borough	1,079	1,[illegible]6	3	22	151	560	425	2,508	2,912	5,420	1,286
Tewkesbury, Borough	1,245	1,434	10	101	64	1,222	148	2,730	3,050	5,780	1,464
Totals	71,254	83,446	794	4263	21,185	33,179	29,082	185,118	201,901	387,019	94,234

The population of Gloucestershire at each of the four enumerations was as under:—

	Males.	Females.	Total.	Increase per cent.
1801	117,180	133,629	250,809	. .
1811	133,192	152,322	285,514	13·83
1821	160,451	175,392	335,843	17·62
1831	185,118	201,901	387,019	15·20

Showing an increase between the first and last periods of 136,210, or not quite 35½ per cent., which is 21½ per cent. below the whole rate of increase throughout England.

County Expenses, Crime, &c.—The sums expended for the relief of the poor at the four dates of—

		£.		s.	d.	
1801	were	109,045,	being	8	8	for each inhabitant.
1811	„	165,576	„	11	7	„
1821	„	152,994	„	9	1	„
1831	„	168,288	„	8	8	„

The expenditure for the same purpose in the year ending March, 1837, was 105,670*l.* Assuming the population to have increased since 1831 in the same proportion as in the ten preceding years, the above sum gives an average of rather more than 5*s.* for each inhabitant. All these averages are below those for the whole of England and Wales.

The sums raised in Gloucestershire for poor's-rate, county-rate, and other local purposes, in the year ending the 25th March, 1833, was 207,741*l.* 13*s.*, and was levied upon the various descriptions of property as follows:—

On land . . .	£130,525	11
Dwelling-houses .	66,651	17
Mills, factories, &c. .	8,527	11
Manorial profits, navigation, &c.	2,036	14

The amount expended was—

For the relief of the poor . .	£176,840	0
In suits of law, removal of paupers, &c.	7,934	10
For other purposes . .	33,619	15
	218,394	5

In the returns made up for the subsequent years, the descriptions of property assessed are not specified. In the years ending March, 1834, 1835, 1836, and 1837, there were raised 205,024*l.* 12*s.*, 177,858*l.* 14*s.*, 162,392*l.* 5*s.*, and 141,323*l.* respectively, and the expenditure for each year was as follows:—

	1834. £.	s.	1835. £.	s.	1836. £.	s.	1837. £.
For the relief of the poor .	161,448	19	130,156	3	116,184	13	105,670
In suits of law, removals, &c.	7,063	10	5,127	14	4,389	2	3,197
Payment towards the county-rate . . .	33,992	13	14,853	10	18,164	13	9,317
For all other purposes			21,634	7	19,521	16	13,332
Total money expended	£202,505	2	171,771	14	158,260	4	131,516

The saving effected in the whole sum expended in 1837, as compared with that expended in 1834, was therefore about 35 per cent.; and the saving effected, comparing the same periods of time, in the expenditure of the poor was more than 34 per cent.

The number of turnpike trusts in Gloucestershire, as ascertained in 1834, is 47; the number of miles of road under their charge is 840; the annual income in 1834, arising from the tolls and parish composition, was 79,400*l.* 15*s.* 3*d.*; and the annual expenditure, 77,326*l.* 6*s.*

The county expenditure in 1834, exclusive of that for the relief of the poor, was 16,103*l.* 7*s.* 7*d.*, disbursed as follows:

	£.	s.	d.
Bridges, building, and repairs, &c.	1,400	3	8
Gaols, houses of correction, &c., and maintaining prisoners, &c. .	4,832	9	10
Shire-halls and courts of justice, building, repairing, &c. . .	800	8	1
Lunatic asylums . .	705	0	11
Prosecutions . . .	5,227	11	11
Clerk of the peace . .	439	5	4
Conveyance of prisoners before trial	641	15	4
„ of transports .	280	5	6
Vagrants, apprehending and conveying	19	5	5
Constables, high and special .	10	7	8
Coroners . . .	475	16	0
Miscellaneous . . .	1,270	17	11

The number of persons charged with criminal offences in the three septennial periods ending with 1820, 1827, and 1834, were 3056, 3369, and 5017 respectively; making an average of 437 annually in the first period, of 481 in the second period, and of 717 in the third period. The number of persons tried at quarter-sessions, in each of the years 1831, 1832, and 1833, in respect of whom any costs were paid out of the county rate, was 330, 356, and 199 respectively. Among the persons charged with offences, there were committed for—

	1831.	1832.	1833.
Felonies . . .	286	236	180
Misdemeanors . .	44	20	19

The total number of committals in each of the same years was 350, 278, and 224 respectively.

	1831.	1832.	1833.
The number convicted was .	270	207	139
„ acquitted .	54	59	70
Discharged by proclamation	21	12	9

At the assizes and sessions in 1836 there were 578 persons charged with criminal offences in this county, and 245 in Bristol. Of these 86 were charged with offences against the person, 54 of which were for common assaults; 44 persons were charged with offences against property, committed with violence; 641 with offences against property, committed without violence; 4 were found guilty of forging; 4 of coining; 7 of uttering bad money; 10 were committed for poaching; 6 for deer-stealing; 2 for riot; and the remaining 21 for miscellaneous minor offences. Of the whole number of persons convicted, 19 were sentenced to death, one of whom was executed; 15 were transported for life, and 3 were imprisoned for terms under two years each; 130 criminals were condemned to transportation for various periods; 21 were sentenced to two years' imprisonment; 92 to one year's or above six months', and 338 to six months'; 4 were whipped, 15 fined, and 6 discharged; making up the whole number of those convicted 625: the remaining 196 were acquitted, or had no bill found against them, or no prosecution ensued. Of the whole number of offenders, 711 were males, and 112 were females; 240 could neither read nor write; 426 could read and write imperfectly; 119 could read and write well; and 6 had received superior instruction; the state of instruction of the remaining 32 could not be ascertained.

The number of persons qualified to vote for the county members of Gloucestershire is 14,443, being 1 in 27 of the whole population, and 1 in 6 of the male population 20 years and upwards, as taken in 1831. The expenses of the last election of county members to parliament were to the inhabitants of the county 251*l.* 18*s.* 7*d.* and were paid out of the general county rate.

This county contains 12 savings'-banks; the number of depositors and amount of deposits on the 20th of November in each of the following years were as under:—

	1832.	1833.	1834.	1835.	1836.
Number of depositors	12,970	14,321	15,577	16,440	17,704
Amount of deposits	£478,663	£509,409	£544,235	£575,030	£607,008

The various sums placed in the savings'-banks in 1835 and 1836 were distributed as under:—

	£.	1835. Depositors.	Deposits.	1836. Depositors.	Deposits.
Not exceeding	20	8,048	£57,626	8,856	£63,023
„	50	4,748	146,212	5,037	156,055
„	100	2,176	150,293	2,272	157,128
„	150	819	98,987	856	103,438
„	200	485	83,022	530	91,430
Above	200	164	38,890	153	35,934

Education.—The following summary is taken from the parliamentary returns on education made in the session of 1835:—

	Schools.	Scholars.	Total.
Infant schools	46		
Number of children at such schools; ages from 2 to 7 years:—			
Males . . .		673	
Females . . .		635	
Sex not specified		1,049	
			2,357

	Schools.	Scholars.	Total.
Brought forward	46		2,357
Daily schools	991		
Number of children at such schools; ages from 4 to 14 years:—			
Males . . .		13,677	
Females . . .		10,973	
Sex not specified		5,267	
			29,917
Schools .	1,037		
Total of children under daily instruction			32,274
Sunday schools	519		
Number of children at such schools; ages from 4 to 15 years:—			
Males . . .		17,605	
Females . . .		17,712	
Sex not specified		5,614	
			40,931

If we assume that the population between the ages of 2 and 15 has increased, since 1831, in the same proportion as the whole population has increased during the 10 years preceding that period, we find that the number of children between the ages of 2 and 15 residing in Gloucestershire, in 1834, was 134,812. Forty-eight Sunday-schools are returned from places where no other school exists, and the children (1674 in number) who are instructed therein cannot be supposed to attend any other school; at all other places Sunday-school children have opportunity of resorting to other schools also; but in what number or in what proportion duplicate entry of the same children is thus produced must remain uncertain. Sixty-one schools (containing 4906 children which are both daily and Sunday-schools are returned from various places, and duplicate entry is therefore known to be thus far created. Making allowance for this cause it may perhaps approximate to the truth to state, that not so much as half the children between the ages of 2 and 15 were receiving instruction in this county at the period this return was made.

Two schools returned in the parish of St. John the Baptist, in the city of Gloucester, are said to have been the first Sunday-schools established in the kingdom.

Maintenance of Schools.

Description of Schools.	By endowment		By subscription.		By payments from scholars		Subscrip. and payment from scholars.	
	Schls.	Scholars.	Schls.	Scholars	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	..	..	8	519	22	365	16	1,473
Daily Schools	143	5,399	101	5,118	661	13,473	86	5,927
Sunday Schools	45	3,097	459	36,512	1	12	14	1,310
Total....	188	8,496	568	42,149	684	13,850	116	8,710

The schools established by dissenters, included in the above statement, are:—

	Schools.	Scholars.
Infant schools . .	3	125
Daily schools . .	24	1,147
Sunday-schools . .	151	17,465

The schools established since 1818 are:—

		Scholars.
Infant and other daily schools	514, containing	19,046
Sunday-schools . .	281, „	26,224

One hundred and fifteen boarding-schools are included in the number of daily schools given above. No schools in this county appear to be confined to the children of parents of the Established Church or of any other religious denomination, such exclusion being disclaimed in almost every instance, especially in schools established by dissenters, with whom are here included Wesleyan Methodists, together with schools for children of Roman Catholic parents.

There are lending-libraries of books attached to 77 schools in this county.

GLOVE (from the Anglo-Saxon *glof*), a cover for the hand. If one did not see the rude Tartars and Samoiedes, says Gough (*Sepulchr. Mon.*, i., p. 185), covering their hands with something like gloves, not divided into fingers, one would be led to think that they were first introduced into Europe by the Christian bishops and emperors. Casaubon asserts, with respect to a passage in Athenæus (xii. 2), that the antient Greeks and Romans knew of no such covering for the hands; though he shows that they were in use among the Romans in the time of Pliny the younger. The Persians used gloves in cold weather, a circumstance charged against them as a proof of their luxurious habits. (Xenophon, *Cyrop.*, viii. 8, 17.)

In England the etymology of the word shows their very early use. With kings, nobles, and prelates in the Middle Ages they were a costly article of dress, and richly decorated, being sometimes, particularly those of bishops, adorned with precious stones. (Warton's *Hist. of Engl. Poet.*, 4th edit., i., p. 182, from Rot. pip. 52 Hen. III. A.D. 1267.)

While the spirit of chivalry lasted, the glove of a lady, worn in the helmet as a favour, was a very honourable token; and much of the wearer's success was supposed to be derived from the virtue of the lady: whence the following boast of Henry of Monmouth, which his father remarks is as dissolute as desperate (*Rich. II.*, act v., sc. 3):—

> 'His answer was, he would unto the stews,
> And from the commonest creature pluck a *glove*,
> And wear it as a favour; and with that
> He would unhorse the lustiest challenger.'

The practice of wearing a glove as a favour is mentioned by Hall in his 'Chronicle,' in the reign of Henry IV., and frequently among our old dramatic writers. (Nares's *Glossary*, in voce.)

Queen Elizabeth's fondness for perfumed gloves is frequently mentioned by the writers on her reign: and especially those which were presented to her by Edward Vere, earl of Oxford, when he came from Italy.

At the sale of the earl of Arran's goods, in the month of April, 1759, the gloves given by Henry VIII. to Sir Anthony Denny were sold for 38*l.* 17*s.*; those given by James I. to his son Edward Denny, for 22*l.* 4*s.*; and the mittens given by Queen Elizabeth to Sir Edward Denny's lady, for 25*l.* 4*s.* Gough (*Sepulchr. Mon.*, i. 185) says, 'These may be supposed some of the oldest gloves extant.'

To throw the glove by way of challenge to duel is mentioned in Matthew Paris's History, under the year 1245. He calls it *mos Francorum*.

GLOVER, RICHARD, author of 'Leonidas,' was born in the city of London, in 1712. His father was a Hamburg merchant: and being intended for the same employment, the son received, it appears, only a common school education. He possessed however a natural love of letters. At sixteen, he wrote a poem on the memory of Newton: and at an early age commenced his 'Leonidas,' an epic poem on the Persian War, published in 1737, in nine books, and afterwards enlarged, in 1770, to twelve. Being supposed to have a political tendency, it was warmly praised by Lord Lyttleton, Fielding, and the court of the Prince of Wales, and in a few years ran through six or seven editions: but its reputation, like that of most things which are unduly elevated by external circumstances, has sunk to, perhaps below, its proper level. It is not deficient in feeling or dignity, and is creditable to the abilities of the author; but much more than good abilities, a cultivated mind, and a musical ear are required to establish the fame of an epic poem. A sort of continuation of the history of the Persian war, called the 'Athenais,' in *thirty books*, was published posthumously in 1787. 'London, or the Progress of Commerce,' and the song called 'Hosier's Ghost,' beginning

> ''Twas near Portobello lying,'

were written to rouse the nation to a Spanish war. The latter is a fine effective ballad, and possesses the best proof of merit—it answered its end. It will probably be read and remembered long after 'Leonidas' is forgotten.

Mr. Glover took an active part in city politics as an opponent of Walpole. In 1760 he became M.P. for Weymouth, and proved himself a good speaker and a valuable man of business in commercial affairs. For an account of his other works and personal history, see Johnson and Chalmers's 'English Poets,' or Chalmers's *Biog. Dict.* The *Gent. Mag.* for November, 1785, the month of his death, contains a character of him, said to be by Dr. Brocklesby, couched in warm terms of praise as to morals and talents.

GLOVES, COMMERCE IN. The great seats of the leather glove manufacture in England are Worcester, Woodstock, Yeovil, Leominster, Ludlow, and London. The number made every year in the town and immediate neighbourhood of Worcester has been estimated to exceed six millions of pairs. At Yeovil about two-thirds of that quantity are supposed to be produced, and the number of persons, including men, women, and children, engaged in the manufacture at these two places, is stated to be continually increasing. This result is altogether contrary to the predictions of persons engaged in the manufacture, who

resisted the removal of the prohibition to import leather gloves from foreign countries, which had been maintained up to the year 1825. Since that time the annual importations of gloves have varied from 1,000,000 to 1,600,000 pairs, principally of French manufacture; and the leather glove-makers have had to encounter a new set of rivals at home, the makers of cotton, or Berlin gloves, a very large number of which have been used of late years; and yet such has been the increased use of gloves, that the old branches of the trade have experienced some increase. The duties charged upon the importation of foreign leather gloves are:—

	s.	d.
On habit-gloves, the dozen pair	4	0
„ men's gloves „	5	0
„ women's gloves, or mitts	7	0

The produce of the duties varies from 20,000*l.* to 30,000*l.* per annum. In order to encourage the home manufacture, the duty upon foreign skins suited for glove-making has been reduced to the merely nominal one of 4*d.* per 100 skins. Silk gloves are principally made in the town of Derby: the manufacture is so connected with that of silk stockings, that it is not possible to distinguish the proportion or amount of each.

GLOW-WORM. [LAMPYRIS.]

GLUCHOFF. [TSCHERNIGOV.]

GLUCI'NIUM, the metallic base of an earth or oxide (*Glucina*) discovered by Vauquelin, in 1798, in the beryl, or aqua marina, and afterwards in the emerald. Before the discovery of potassium, glucina and all other earths were considered as simple substances. Glucinium was first obtained from glucina in 1827 by Wöhler, who procured it by decomposing the chloride of glucinium. Obtained in this mode, glucinium is a fine powder of a deep grey colour, which is very difficult of fusion. When burnished it acquires the metallic lustre. It suffers no change by exposure to air or water at common temperatures; but when heated to redness, it burns, combines with oxygen, and is converted into glucina. Dilute acids and solution of potash dissolve glucinium, with the evolution of hydrogen gas, and its consequent conversion to glucina.

Glucina, the only known oxide of the metal, is obtained from the minerals which contain it, by fusing with carbonate of potash, and treatment with acids and with carbonate of ammonia, which dissolves the glucina, and leaves the alumina unacted upon; the carbonate of ammonia being expelled by heat, pure glucina remains.

The properties of glucina are, that it is a light white powder, which has neither smell nor taste, infusible, insoluble in water and solution of ammonia, but soluble in potash and soda; its specific gravity is about 3. Its composition, as determined by the analysis of the sulphate, is

1 equiv. of oxygen . .	8
1 equiv. of glucinium . .	18
Equivalent	26

Glucinum combines readily also with chlorine, iodine, bromine, sulphur, &c.

Chloride of Glucinium is obtained by cautiously evaporating a solution of glucina in hydrochloric acid. The residue is colourless, sweet, very fusible and volatile, and sublimes readily in white brilliant needles; it deliquesces in the air, and dissolves largely in water with the extrication of heat. When procured by evaporation, it is a gummy mass which contains water, and when heated in the air is decomposed into hydrochloric acid and glucina. It is composed of

1 equiv. of chlorine . . .	36
1 equiv. of glucinium . . .	18
Equivalent	54

Sulphuret of Glucinium is formed by heating the metal in the vapour of sulphur. Much heat is given out, and a grey sulphuret of the metal is obtained, which is soluble in water and decomposed by acids with the evolution of hydrosulphuric acid.

The salts which glucina forms with acids are not important; we shall therefore mention only their general properties. They are all colourless, except the chromate, which is yellow; the taste is sweet, and hence the name of the earth, and slightly astringent. With potash and soda they give a white precipitate of hydrate of glucina, which an excess redissolves; but ammonia in excess does not redissolve the hydrate. The carbonate of ammonia in excess redissolves the precipitated carbonate, and so also do, slightly, the carbonates of potash and soda. Neither ferrocyanide of potassium nor tincture of galls gives any precipitate. With fluoride of potassium there is produced a double salt which crystallizes in small scales, provided the solutions are hot, and the admixture is continued till the solutions begin to be turbid.

GLUCK, CHRISTOPH, who possesses so indisputable a claim to be considered the first German, of what may be called modern times, that not only rivalled but surpassed the Italians in the composition of opera music, and with whom originated a new and superior style, was born, of humble parents, in the Upper Palatinate, on the borders of Bohemia, in 1714. When very young he lost his father, and was totally neglected; but the genius for music, so common in the natives of his country, was in him more than ordinarily vigorous, and, self-taught, he contrived by his talents to work his way to Vienna, where his industry furnished him with the means of procuring not only subsistence but education. He there obtained the patronage of a nobleman, who took him into Italy, and at Milan he received some most valuable instructions from the celebrated theorist Padre Martini. Having successfully given birth to two or three operas, his reputation spread abroad, and Lord Middlesex, then dictator of the King's Theatre, engaged him as his composer. But the rebellion of 1745 had just broken out, and all foreigners were regarded with suspicion, the theatre therefore was, by order, closed, and only re-opened by the influence of the noble manager, who conciliated government by a *piéce de circonstance*, a demi-political drama, entitled *La Caduta dei Giganti* (The Fall of the Giants), set by Gluck as his introduction to a British public. It however excited little interest; the dancing of Madlle. Violetta (afterwards Mrs. Garrick) in this made more impression than the music. In the following year he composed another opera, *Artamene*, and brought out a Pasticcio, but with no marked success, for, in truth, he had not at that time reached his full strength. He then returned to Italy, where he formed an intimacy with Calzabigi, the poet, and the two concerted a reform of the Italian opera, which was carried out in the instances of *Orfeo* and *Alceste*, both of which were produced at Vienna, the former in 1764, the latter in 1769. Such was now his reputation, that he was invited to compose an opera for the French *Académie Royale*. For this he wrote his *Iphigenie en Aulide*, which was brought out at Paris, under his own direction, in 1776, and completely triumphed over the national prejudices opposed to it; but not without a violent struggle, in which the unfortunate Marie Antoinette, who had been Gluck's pupil, took an active part in favour of the German stranger. He was now hailed as the reviver of that music which had wrought such miraculous effects in antient Greece, and the native French composers were cast into the background: when the Italian party, aroused by the success of what they called the barbarous Tedescan school, invited to Paris the idol of Naples, the justly-celebrated Piccini. A furious musical war now broke out in the capital of France, and was carried on with a violence never before or since equalled, and which only could have been supported by a people so alive to whatever relates to the fine arts, particularly those immediately connected with the theatre. The most eminent of the French literati engaged with extraordinary zeal in the contest, and were nearly equally divided. To such a length was the dispute carried, that it has been said, without any figure of speech, no two persons met without inquiring to what party each belonged: —*Etes vous Gluckiste ou Picciniste?*—the reply determining whether the conversation should have an amicable or a hostile bearing.

Besides the abovementioned operas, Gluck produced several others, the best of which are *Armide, Iphigénie en Tauride*, and *Echo et Narcisse*. He returned to Vienna in 1784, and shortly after was attacked by paralysis, which terminated his life in 1787. This truly great composer possessed a powerful and original mind. Nothing from his pen betrays the slightest attempt to imitate, or in any way unduly profit by, the works of others. His melodies are beautifully tender, and rarely, if ever, assume any appearance of gaiety. Indeed, passion is the characteristic of his, as well as of most German dramatic music. His choruses are marked by that simplicity which, in his opinion, as well as in that of many able critics, is so conducive to effect on the stage; and his orchestral accompaniments are as re-

markable for their appropriateness as for their richness, the period at which they were written being considered. Gluck was, in a word, an intellectual composer, of which fact his works afford incontestable proofs.

GLÜCKSTADT. [HOLSTEIN.]

GLUE, a well-known substance employed to effect the adhesion of different portions of wood in carpentry, &c. It is prepared from the clippings of hides, hoofs, &c., obtained at the tan-yard. The first operation is to wash them in lime-water, and afterwards to boil them in water, and skim the solution, which is rendered clear by being strained through baskets, and is then evaporated by a gentle heat to a proper degree of thickness. It is finally cooled in wooden vessels, cut into thin portions, and dried upon coarse net-work. When properly prepared, glue is of a deep brown colour, translucent, and free from spots and clouds. When required for use, it is broken into pieces, and steeped for about twenty-four hours in cold water, by which it swells and softens. When gently heated in a water-bath, such as the common glue-pot is, it is applied by means of a brush to the various kinds of work for which it is used. The adhesion depends upon the evaporation of the water.

Another variety of glue, which is much softer and called *size*, is obtained from parchment cuttings and several animal membranes. It is used by paper-hangers, white-washers, &c. Glue and size consist principally of what is chemically termed *gelatin*, of which isinglass, procured principally from the sturgeon in Russia, is the purest kind.

GLUMACEOUS PLANTS are what are more commonly called Graminaceæ and Cyperaceæ, to which Junceæ and a few other orders are occasionally added. They derive their name from the flowers' consisting of glumes only.

GLUTEN. [FOOD, vol. x., p. 343.]

GLUTTON (Zoology), the vernacular name for the Wolverene. [GULO.]

GLYCERIN. [SOAP.]

GLYCY'MERIS. (Zoology.) [PYLORIDEA.]

GLYCYRHI'ZA is a genus of pea-flowered Exogens, consisting of herbaceous plants with pinnated leaves, small flowers in axillary spikes, and roots running very much in the soil in which they grow. The technical character of the genus is given by De Candolle thus: 'Calyx naked, tubular, 5-cleft, bilabiate; the two upper lobes grow together beyond the others. Standard ovate-lanceolate, straight; keel two-headed, or 2-petalled, straight, acute. Stamens diadelphous. Style filiform. Legume ovate or oblong, compressed, 1-celled, 1-4-seeded.'

One of the species, Glycyrhiza glabra, a plant growing wild all over the south of Europe from Spain to the Crimea, produces the common liquorice roots of the shops, from which the well-known black extract of the same name is obtained. It is a perennial, of a pale green colour, growing two or three feet high; and has ovate bluntish leaflets, glutinous on the underside, pale blue flowers in spikes shorter than the leaves, and short smooth pods, each containing from two to three seeds.

Other species of Glycyrhiza, especially G. echinata, have also sweet roots, but they are inferior to the officinal species.

This plant is cultivated in many parts of England, especially about Pontefract, whence the name of Pomfret cakes, applied to a fine preparation of liquorice. Though commonly grown in the field, it requires very superior culture in order to produce fine roots for sale in the market. The soil in which it delights to grow is rich black mould, but where this cannot be procured a fresh loam will answer the purpose, provided there is not much wet clay in its composition. It must be at least three feet deep to allow a free passage for the roots, as they are generally expected to be a yard in length, and as the straight ones are more highly prized than those which are crooked. On this account the spade is more useful than the plough in cultivating the ground, and though it may at first be expensive, yet the husbandman will in the end be well repaid for his trouble.

After the ground is fixed upon, it must be well covered with good rotten dung, trenched three feet in depth, and left in this state during the winter, to be mellowed by frost. About March, if the weather is fine, the plantation should be formed. Plants are either raised from seeds, or, as is more commonly the case, from a division of the old roots, which are cut into pieces eight or ten inches long. Choice should be made of those which, as planters term it, have good eyes, that is, buds, and which are more likely to push and grow strong.

A garden line must then be set for the first row, and holes made with the setting-stick about a foot and a half apart; into which the sets must be dropped and covered about two inches with soil. The rows must be at least three feet apart, and the plants in one row should be alternate with those of the other; this will not only give them more room, but will have a neat appearance, forming regular rows from whatever part the field is viewed.

'For the first year,' says Abercromby, 'you may cultivate a light crop of lettuce or onions between the rows. During summer, keep the ground free from weeds, and when the subordinate crop comes off, hoe and dress the ground. At the close of autumn, or as a winter dressing, fork or dig between the rows to stir and refresh the surface; and cut down the decayed stems. After three or four years' growth, the main roots will be of a mature size, and fit for consumption or the market. It is an excellent plan to cover the crowns of the plants in winter with good rotten dung, as it not only preserves them from severe frosts, but is washed down by the rain, and becomes valuable nourishment to the roots.'

Glycyrhiza glabra.

GLYCYRHI'ZA GLABRA, liquorice, of which the root, or rather the rhizoma, and a watery extract are officinal. It is a native of Germany, but cultivated extensively in some parts of Britain; the extract is however chiefly prepared in Spain, and imported under the name of Spanish juice, or liquorice. The rhizoma is generally allowed to attain the age of three years, and is then taken up. It is often several feet in length, and about half an inch thick. The odour is faint, the taste sweet but mawkish; and if the bark be chewed, it is at last rather acrid, which is owing to the presence of a soft resin.

Robiquet found it to contain a peculiar sugar, which is uncrystallizable, called *glycion* or *glycyrhizin*, and other matters.

Infused in warm or macerated in cold water, it affords a mucilaginous fluid, which is bland and demulcent. The powder is much used to involve recently made pills, in order to prevent them from adhering to each other.

The extract is formed into rolls from six to eight inches long, which are dried, and surrounded with bay leaves, to prevent them from adhering, as in warm weather they have a tendency to melt, notwithstanding the addition to them of

starch or peas-meal: 100 lbs. of the dried root yield 30 lbs. of extract.

Good liquorice juice is black, dry, easily broken (in cold weather), with a shining fracture. It should dissolve easily and entirely in the mouth, when pure; but crude liquorice, besides starch or meal, has generally more or less copper, rarely brass, derived from the pans in which it has been boiled; it is therefore subjected to a process of purification, and is then termed *refined* liquorice. This is done by melting it in water, draining off the solution, so as to leave the sand and other impurities behind, and inspissating it; then forming it into more slender cylinders, which are generally soft and moist, even when sugar has been added to them: a better addition is a small quantity of gum arabic. In Yorkshire an extract is prepared which is sold under the name of Pontefract cakes.

Both the crude Spanish and refined liquorice are used as demulcents, to allay tickling cough in slight cases of catarrh.

GLYKAS. [BYZANTINE HISTORIANS, vol. vi., p. 82.]

GMELIN, JOHN GEORGE, born at Tübingen in 1709, applied himself to the study of natural history and chemistry, in which he became distinguished. On going to Petersburg he was made a member of the Academy of Sciences of that capital. In 1733 he was sent by the Empress Anna to explore Siberia, in company with G. F. Müller and other men of science. This very laborious and interesting expedition lasted nearly ten years. Gmelin examined those vast and dreary regions as far as the banks of the Lena. His object was to proceed to Kamtchatka, but the state of his health and other difficulties made him retrace his steps to Petersburg, where he published his 'Flora Sibirica,' 4 vols. 4to. 1747. Having returned to his native country, he was made professor of botany and chemistry at Tübingen, where he died in 1755. His 'Travels' ('Reise durch Sibirien') were published at Göttingen in 1751. Gmelin was one of the first explorers of the northern part of Asia. A genus of Asiatic plants was named Gmelina by Linnæus, in honour of J. G. Gmelin. [GMELINA.]

GMELIN, SAMUEL GOTTLIEB, nephew of the preceding, was born at Tübingen in 1744, studied in that university, where he applied himself chiefly to the natural sciences, and took his degree of M.D. In 1767 he went to Petersburg, and in the following year he was sent by the Empress Catherine on a scientific tour through the southern provinces of Russia. He first visited the banks of the Don, or Tanais, down to Tscherkask, the capital of the Don Cossacks, from whence he proceeded to Astrakhan in 1769, and examined the banks of the Wolga and the delta of that river. In 1770 he sailed on the Caspian Sea, explored its western coast, visited Derbend and Baku, and the mouths of the Koor, and wintered at Enzelly. In the following year he continued his tour along the southern coast, visited the Persian provinces of Ghilan and Mazanderan, and then returned to Astrakhan, where he prepared the narrative of his journey for the press. He next visited the colony of Sarepta, and crossed the Kooman steppes to Mosdok. In 1773 he again left Astrakhan, for his second and last voyage on the Caspian, and after exploring several parts of the Persian coast, he left his ship at Enzelly, and proceeded, in January, 1774, by land, to Baku, and from thence to Derbend. Being peremptorily ordered away by the khan, or governor of that place, he endeavoured to reach by land Kisliar, the nearest Russian settlement on that side, but was seized on the road by a party of the Kaitak tribe, whose khan Usmey confined him in a prison at Achmetkent, in the mountains of the Caucasus, where he died of ill health and bad treatment, in June, 1774. The Empress Catherine provided for his widow. His travels, 'Reise durch Russland zur untersuchung der drey Natur Reiche,' in 4 parts, with numerous plates, were published at Petersburg. The last volume contains a biographical notice of the author. Gmelin wrote also 'Historia Fucorum,' and made other contributions to natural history.

GMELIN, JOHN FREDERICK, was born at Tübingen in 1748, where he studied, and took a doctor's degree in 1769. He early devoted himself to the study of natural history, and, after finishing his education, and travelling through Holland and England, he returned to Tübingen, where he principally occupied himself with giving lectures on natural history and botany. He here acquired sufficient reputation to be admitted among the members of l'Académie des Curieux de la Nature; and in 1775 he was appointed professor extraordinary of medicine at Tübingen. He afterwards got the same appointment at Göttingen, which he held till his death, in 1804. During the thirty years of his academical career he published numerous works, which show the extent and variety of his knowledge and learning, but do not say much for his talents or judgment. His most important works are his historical compilations or dictionaries; but he is best known as the editor of the thirteenth and last edition of the 'Systema Naturæ' of Linnæus, which was first published at Leipzig, in 9 parts, 8vo., between the years 1788 and 1793. It is divided into 3 tomes, one to each kingdom, and is furnished at the end with alphabetical and polyglot tables of the systematic and trivial names. We cannot better describe the merits of this work than in the words of Cuvier, who says 'that it is executed without judgment. It is an ignorant compilation, useless to the professor, and more likely to mislead the student than to enlighten or instruct him. In fact, under the pretence of giving a complete list of synonymes, he collected indiscriminately all the names which he found in different authors, without observing whether such an animal, plant, or mineral had been differently designated by different naturalists; so that the same name has often been given to distinct objects. This double error, of which the work of Gmelin offers thousands of examples, shows that the too prolific writer had but a very superficial knowledge of his subject, and did not study the book of nature.'

This work, however, though badly arranged, devoid of criticism, and showing the author's ignorance of the different species which he describes, yet possesses some value as being the only book which includes all the objects of natural history which had been described up to the year 1790. Gmelin wrote numerous works and papers on botany and chemistry. A list of his writings is given in the 'Biographie Universelle,' and in the 'Biographie Médicale' of the 'Dictionnaire des Sciences Médicales,' whence this notice is principally taken.

GMELI'NA, an Asiatic genus of plants named after Gmelin, the author of 'Flora Sibirica,' belonging to the family of Verbenaceæ, of which only one species was formerly known, but five are described by Dr. Roxburgh, and a sixth (with some doubtful species) noticed by Dr. Wallich, in his 'Indian Catalogue.'

The genus is characterized by having a small four- sometimes five-toothed calyx, the corol large, obliquely campanulate, the border irregularly four-parted, something like those of foxglove in shape, but mostly yellow in colour. Stamens four, didynamous, with the anthers two-cleft. Germ superior, four-celled; cells one-seeded; attachment sub-superior. Drupe with a nut, from one to four-celled. Embryo erect, without perisperm. All the species of Gmelina form shrubs or trees, of which the latter are valued for their timber. They are found in the islands of the Indian Ocean, extending thence into the Malayan and Indian peninsulas. *G. asiatica* and *G. parvifolia* are common in various parts of India, and *G. arborea* extends from Prome and Martaban even to the Deyra Valley, in 30° N. latitude.

The leaves of *G. parvifolia* are remarkable for rendering water very mucilaginous; but *G. arborea* (*Goombar* and *Koomhar* of the natives) appears to be the most valuable for its timber, as, besides being spread over a wide extent of territory, it attains great size. Dr. Roxburgh mentions it squaring into logs of from 18 to 24 inches, which are occasionally nearly 30 feet long. The wood resembles teak, the colour being the same; the grain rather closer, but it is somewhat lighter. It seems particularly valuable for situations where it is exposed to both the influence of air and of water. One experiment was made by placing part of an outside plank in the river Hoogly, a few miles below Calcutta, 'a little above low-water mark, exactly where the worm is thought to exert its greatest powers.' Dr. Roxburgh states, that 'after remaining three years in this situation, though examined from time to time, the piece was cut, with the view of carrying a specimen of it to England; and, to my great joy, I found it as sound and every way as perfect throughout as it was when first put into the river.' (*Fl. Ind.*, iii., p. 85.) In another experiment this wood remained good for seven years, while teak, similarly placed, required to be replaced after six years. Hence Dr. R. suggests experiments on and employment of this wood in ship-building.

GMÜND. [IAXT.]

GNAT. [CULICIDÆ.]

GNA'THODON, a genus of conchifers with the ligament inclosed in the cartilage pit, established by Mr. Gray, who exhibited (October, 1836) this peculiarity of structure in the part in some mactraceous shells, at a meeting of the Zoological Society, observing that it was also found in a new genus that he had named at the British Museum *Mulinia*, of which he had described five species; he also stated the necessity for forming a new genus, of which *Mactra spengleri* may be regarded as the type. (*Zool. Proc.*, 1836.)

GNATHOPHYLLUM. (Zoology.) [PALEMONIDÆ.]

GNATHO'STOMA (γνάθος, a jaw, and στόμα, the mouth), a genus of nematoid Entozoa [ENTOZOA], lately discovered by Mr. Owen in the stomach of the tiger. These worms, the largest of which are about an inch in length and a line in diameter, were found in the substance of several small cellular tumours, situated immediately beneath the mucous membrane of the stomach, and apparently formed by the condensation and thickening of the submucous cellular tissue, which was probably owing to the irritation of the Entozoa. Only a pair of these animals was found in each tumour, and they always consisted of male and female, the former of which was about one-fourth smaller than the latter.

In both sexes the body is round, elastic, and attenuated at both extremities; the tail is more obtuse and bent in the male; the head is obtuse and truncated in both of them. The integuments are transparent, and, from the intestinal and genital tubes showing through the surface of the body, appear to be striated transversely. The anterior two-thirds of the body are covered with a circular series of minute reflected spines, each furnished with three points. The mouth is surrounded by a tumid circular lip, and armed with several rows of spinous processes of a similar structure to those on the body. The orifice of the mouth itself is bounded on each side by a jaw-like process (whence the name of the genus), the anterior margin of which is formed into three straight horny points, or processes, directed forwards. The male organ of generation consists of a slightly curved slender spiculum, not furnished with a sheath as in the *strongylus* (the genus of previously described nematoid worms, to which the *gnathostoma* bear the closest resemblance), and surrounded by eight distinct pointed papillæ.

The most interesting point in the internal structure of this entozoon, and which does not appear to have been hitherto detected in any other animal of this class, is the existence of a distinct salivary apparatus, similar to what is found in the *Holothuria*, and other Echinodermata. 'This apparatus,' says Mr. Owen, 'consists of four elongated straight blind tubes, each about two lines in length, which are placed at equal distances around the commencement of the alimentary canal, having their smaller extremities directed forwards, and opening into the mouth, and their closed obtuse ends passing backwards into the abdominal cavity. When examined with a lens of a quarter of an inch focus, the parietes of these salivary tubes present very distinct oblique or spiral decussating fibres; their contents are semipellucid in the recent worm, but become opaque in spirit of wine.' The existence of this salivary apparatus along with the more perfect organs of mastication, as the jaws, in this entozoon is highly interesting, as it shows an approximation to the structure of the digestive organs in the higher classes of animals.

Mr. Owen has since found the Gnathostoma in the stomach of other animals of the cat kind, as the leopard.

Beautiful preparations of both the male and female worms dissected, are preserved in the museum of the College of Surgeons in London (Zoological series, Gallery).

GNEISS, a German term for the lowest series of stratified primary rocks, the introduction of which marks the obligations which British geologists owe to the school of Werner; while such terms as lias, cornbrash, golt, &c., record the original discoveries of Smith and other English writers. As there are no organic remains in the gneiss strata, and the variations of its composition and structure appear independent of the relative antiquity of the deposits, it is impossible, except by the help of the included limestones, quartz rocks, clay slates, &c., even to attempt the division into formations of the vast thickness of the gneiss strata which appears in the Highlands of Scotland, the mountains of Scandinavia, &c.

Composition.—Gneiss is generally a compound of the same three minerals as granite, viz. quartz, felspar, and mica. In the same manner as granite varies in the proportion of its ingredients, the magnitude of the component crystals, the absence of mica, or the substitution of other minerals for it, so gneiss exhibits corresponding variations.

Dr. MacCulloch, whose examination of the gneiss tracts of Scotland was very complete, presents an extended synopsis of the varieties of gneiss which he had observed. His table includes indeed a great number of mineral compounds different from the general character of gneiss, but is nevertheless valuable to the geologist. He considers gneiss in three divisions: first, of regular composition, containing at least three of the four minerals, quartz, felspar, mica, and hornblende; secondly, of irregular composition, containing compact felspar; and thirdly, of irregular composition in other respects. (*Treatise on Rocks.*)

We shall content ourselves with extracting the synopsis of the first division.

Granitic gneiss. This is always large grained.
- *a.* Composed of quartz, felspar, and mica.
- *b.* „ quartz, felspar, and hornblende.
- *c.* „ quartz, felspar, mica, and hornblende.

Schistose gneiss: the structure is foliated like mica-schist, or granular like quartz rock.
- *a.* Composed of white felspar and quartz in minute grains, with rare scales of mica (resembles quartz rock).
- *b.* Composed of felspar and quartz as above, but with abundance of mica (so as to resemble mica schist).
- *c.* In this the mica is extremely abundant, so as to form continuous laminæ.
- *d.* In this the mica is predominant, and there are large interspersed crystals of felspar.
- *e.* Composed of large grains of quartz and felspar with little mica.

Laminar gneiss: each substance occupying a distinct lamina.
- *a.* Composed of quartz and felspar.
- *b.* „ quartz, felspar, and mica.
- *c.* „ quartz, felspar, and hornblende.
- *d.* „ felspar and hornblende.
- *e* „ quartz, mica, and hornblende.

All the varieties of rock comprised under the title of gneiss are stratified, the beds varying much in thickness, and being most remarkably subject to contortions both on a large and small scale, especially where granite veins cross the laminæ. [GEOLOGY; ROCKS; STRATIFICATION.]

GNOMIC POETS OF GREECE. Under this title are included those moral and philosophical poets whose remains consist chiefly of short sententious precepts or reflections. Such are the Gnomæ of Theognis, which, though numbered consecutively as a connected poem to 1200 lines, form in fact a collection of unconnected members, varying from two to thirty lines in length. Such also were the sentences inscribed by Hipparchus on the Hermæ in the streets of Athens. These metrical precepts were valuable before writing became common; being, like proverbs, serviceable and easily-remembered rules of conduct. This notion of a pithy saying, or apophthegm, is one of the meanings of γνώμη (gnóme), whence comes the adjective γνωμικός (gnomikos), relating to gnóme. Winterton's 'Poetæ Minores Græci' (Cambridge, 1677, and later editions) contain a collection of the Gnomic poets. They have also been edited by Brunck (*Gnomici Poetæ Græci*, Argent., 1784, 4to.). The principal authors contained in this edition are Theognis, Tyrtæus, Solon, Simonides, with many others, some to the extent only of a few lines. Tyrtæus and Simonides however, though the authors of Gnomæ, hardly come under the definition above given, or under any other definition which accurately characterizes Theognis and others. Brunck's edition contains also a collection of Gnómæ from the comic writers.

The Gnomic writers are sometimes all classed under the general name of Elegiac poets. [ELEGY.]

GNO'MON (the Greek γνώμων), or style of a dial, is the plate which projects from the surface of the dial-plate, the edge of its shade determining the hour-line. The plates now in use being flat, the gnomon is in the plane of the meridian, and its sloping edge forms an angle with the horizon equal to the latitude of the place, and is consequently parallel to the axis of the earth. No sensible error is made by confounding the edge of the gnomon with the earth's axis; but in lunar dials a sensible error would arise, except

in places of which the latitude is nearly 90°: this error, in either case, depends upon the parallax of the luminous body, and the position of the dial-plate. The antients, who used hemispherical dial-plates, placed the radius which threw the shade in the direction of the north pole-star, and therefore the hour-lines were circular arcs, at regular intervals of 15°. Herodotus says (ii. 109) that the Greeks borrowed the gnomon and the sphere (πόλος) from the Babylonians.

The science of gnomonics, upon which many formal treatises have been written, has declined as the theory of astronomy has advanced towards correctness. In the succeeding article one method of construction of a dial will be briefly explained. It is not worth while to enter upon the details of constructions which are now of no use. A sundial may be sufficiently well adjusted to give the time within a few minutes, provided the observer has an almanac, or some other work in which the equation of time is contained, by which the indications of the sun are made to agree with those of the clock. [SUN.]

GNOMONIC PROJECTION. The gnomonic projection of any portion of a sphere is that which is constructed on the supposition that the eye is in the centre of the sphere. The consequence is, that any great circle whatsoever of the sphere is projected into a straight line; which property can belong to no other projection.

The most convenient method of projecting the whole sphere gnomonically is to imagine a cube inscribed about it, on each face of which one-sixth part of the sphere is projected, by lines drawn through the centre. The maps of the earth and of the stars published by the Society for the Diffusion of Useful Knowledge are drawn in this manner, a full account of which may be found in the 'Explanation of the Maps of the Stars,' (Baldwin, 1836). The result is six maps, which embrace the whole sphere; the shortest distance from any one point to another on the sphere being projected into the shortest distance between their corresponding points on the map, when they lie on the same map.

The gnomonic projection derives its name from the connexion between the methods of describing it and those for the construction of a gnomon or dial. The direction in which the shadow of a line parallel to the axis of the earth will be thrown is the intersection of the hour circle for the time being with the surface of the dial (whether plane or not). Imagine a sphere, and the surface of the dial drawn through its centre. Upon this sphere describe the heavens, and project the whole upon a circumscribed cube. Nothing is more easy than to draw the hour circle upon such a projection, and if the intersection of the surface of the dial with the cube be traced out upon the cube, the points at which the projections of the hour circles meet the intersection of the cube and the dial are those towards which the shadow of the axis will point at the hour in question. When a dial is to be constructed geometrically, this is the most simple plan: but calculation, as in other instances, is superior to construction for purposes of accuracy.

GNOSSUS. [CANDIA.]

GNOSTICS, derived from the Greek word *gnōsis* (γνῶσις), 'knowledge,' was employed by the fathers of the first two centuries as a generic term to designate all individuals who professed to interpret the Scriptures by the aid of philosophy. It is supposed from various passages in the New Testament (*Col.* ii. 8; 1 *Tim.* i. 4; vi. 20; 2 *Tim.* ii. 16, 17; *Titus*, iii. 9; 1 *John*, ii. 18) that the doctrines of the Gnostics were taught in the times of the Apostles; and the Nicolaitans, who are condemned by St. John (*Rev.* ii. 6, 15), are looked upon by the fathers as forming a sect of the Gnostics. Many of the fathers consider Simon Magus, Dositheus, and Menander to be the first individuals who propagated Gnostic opinions; but they are more correctly classed by others among the opponents rather than the corrupters of Christianity. The principal teachers of Gnosticism were Saturninus, Basilides, Cerinthus, Carpocrates, and Prodicus, of whom the most celebrated were Cerinthus and Carpocrates. Irenæus (*Adv. Hæres.*, iii. 11) states that St. John wrote his gospel in order to refute the errors of Cerinthus; but many critics reject this testimony of Irenæus, and maintain that Cerinthus lived in the second century. The Ebionites also [EBIONITES] are supposed to have been Gnostics.

The origin of the Gnostic system has been traced to various sources. Some have derived their doctrines from the Alexandrian school of philosophy; others from the Jewish Cabbala [CABBALA]; and a still greater number from the Oriental belief in two great independent principles, one the author of good, and the other of evil. Many parts of the Gnostic system may be alleged in favour of each of these suppositions; but it seems to be forgotten that Gnosticism is merely a generic term, and that it included many sects that differed considerably from each other: we should therefore regard it rather as derived from all these antient systems than formed from any one in particular. For the reasons that have already been mentioned, it is difficult to give an account of their opinions that will apply equally to all the sects into which the Gnostics were divided; but the following abstract contains the doctrines which were regarded by the fathers as characteristic of Gnosticism.

They looked upon matter as intrinsically evil, and therefore maintained that God could not have created the world. They believed that God dwelt in a *plērōma* (πλήρωμα) of inaccessible light, and that he was unknown to the world before the coming of Christ; that he created two other beings, called *Æons*, or emanations; that from these other Æons were descended; that from these Æons an inferior order of spirits was derived, and among the others one named *Demiurgus*, who created the world and rebelled against God; that this Demiurgus was the God of the 'Old Testament;' that Christ, who was one of the Æons, was sent into the world to restore men to the *gnosis* (knowledge) of the true God; that the Æon Christ descended into the man Jesus at his baptism, and left him when he was led to crucifixion, so that the man Jesus alone suffered. Their belief in the evil of matter led them to reject the doctrine of the resurrection. They maintained that an individual at his death was raised to inhabit the divine pleroma, into which corruptible and sinful matter could not enter.

Their doctrines are said to have produced very opposite effects upon their moral conduct; some, looking upon the body as sinful, mortified it by severe penances; while others, with the same opinion, led immoral lives, maintaining that the soul could not be affected by the acts of the body.

(Neander, *Kirchengeschichte*: Mosheim, *Ecclesiastical History*; Burton, *Bampton Lectures*; Lardner's *History of Heretics*.)

GNU, or GNOO. [ANTELOPE, vol. ii., p. 90.]

GOA, the capital of the Portuguese possessions in India, is situated in the province of Bejapore, on an island about 24 miles in circumference, formed by the river Mandova, and stands in 15° 30′ N. lat., and 73° 58′ E. long. The antient city, which, being unhealthy, is now deserted by all its inhabitants, with the exception of a few miserable ecclesiastics, was once a splendid and populous place, containing many magnificent dwellings and a great number of elegant churches and monasteries. The new town, to which the name of Panjim has been given, stands five miles nearer the sea than the antient city. It is a handsome, well-built place, with 18,000 to 20,000 inhabitants. With the exception of the viceroy and the principal functionaries, who are natives of Portugal, the inhabitants are mostly a mixed race, the descendants of European, Portuguese, and Indian women. They profess the Roman Catholic religion, but its rites are mixed with various Pagan forms and customs. Their language is a dialect made up of the languages of Portugal, Canara, and the Maharattas. (Rennell's *Memoir of a Map of Hindustan*; C. Buchanan's *Christian Researches in Asia*; Hamilton's *East India Gazetteer*.)

GOAT, the English name for the well-known horned ruminant Αἴξ (ὁ καὶ ἡ, but generally used for the female), τράγος, χίμαρος (the male), ἔριφος (young male kid of three or four months), χίμαιρα (young female before its first winter), of the Greeks; *Caper*, and *Hircus* (male), *Capra* (female), *Hœdus*, or *Hædus* (a young male kid), *Hœdulus*, or *Hœdillus* (a very young male kid, or kidling, ἔριφος), *Capella* (female kid), of the antient Italians; *Becco* (male), *Capra* (female), *Capretto*, and *Caprettino* (kid and kidling), of the modern Italians; *Bouc* (male), *Chèvre* (female), *Chevreau* (kid), of the French; *Cabron* (male), *Cabra* (female), *Cabrito* (kid), of the Spanish; *Cabram* (male), *Cabra* (female), *Cabrito* (kid), of the Portuguese; *Bock* (male), *Geisz* (female), *Bocklein* (kid), of the Germans; *Bok* (male), *Giyt* (female), of the Dutch; *Bock* (male), *Geet* (female), *Küdh* (kid), of the Swedes; *Buk*, *Geedebuk* (male), *Geed* (female), *Kid* (kid), of the Danes; *Bwch* (male), *Gafr* (female), *Mynn* (kid), of the Antient Britons.

The goat affords another example of the uncertainty which clouds the history of our domestic animals; and to this day zoologists are not entirely agreed as to the species

from which it is derived. One of the latest writers on the subject, who is well known for his industry, as well as his acuteness and accuracy, writes thus (1837):—'The opinions of naturalists have been much divided respecting the original stock of our domestic goat; some referring it to the *Ægagrus*, and others to the *Ibex*. Buffon appears to have adopted the latter opinion; but most modern zoologists who have paid much attention to the question, and who have brought to the consideration of it all the helps which recent discoveries in philosophical zoology have furnished, have leaned to the belief that the *Ægagrus*, or wild goat of the mountains of Caucasus and of Persia, is the true original stock. The zoological characters of this animal certainly bear a closer resemblance to those of the domestic breeds; and it is worthy of remark, that the horns of the Persian domestic goat, though smaller, are similar in form to those of the *Paseng*, or *Ægagrus*. The arguments which have been urged from the intermixture of the *Ibex* with the common goat are at present of little value, as the facts recorded are very deficient. The large goats which are reported to have been brought from the Alps and the Pyrenees to the Garden of Plants in Paris, and which were stated to have been wild, were probably the progeny of the *Ibex* with the common goat, as there is no proof of the existence of the true *Ægagrus* in Europe. These were found to be capable of producing offspring, and the details are given by M. Fred. Cuvier with great clearness: but the old fault still remains; the question is not set at rest by these observations; for we are only informed that they produce offspring, without any statement whether they will breed *inter se*, or only with the common goat. The progeny however were either prematurely brought forth, or lived only a short time in a sick or languishing condition. Surrounded by these doubts, and without the power of satisfactorily solving them, it is better perhaps to leave the question to be decided by future experiments, should the opportunity ever occur of determining the results of inter-breeding between the *Ibex*, the *Ægagrus*, and the common Goat, particularly with reference to the *mutual* fertility of the offspring.'*

Buffon's opinion is not very clearly stated, nor is it certain that he had a very distinct idea on the subject. Sonnini, in his 'Travels in Greece and Turkey,' after speaking of the wild solitudes that surround the Convent of St. John at Cape Malacca, in Candia, says, 'Covies of red partridges delight in these inaccessible mountains, and there they live in safety. There also are to be seen wild goats, which leap from rock to rock with admirable address and agility. These wild goats, which are to be met with in the Isle of Candia, and several other islands of the same sea, are of the *Bouquetin* (*Capra Ibex*, Linn.), or mountain-goat species. The modern Greeks, as has been done by their ancestors, confound the *Bouquetin* and the *Chamois* under the same denomination of *Wild Goat*. The French, habituated to the Levant, also knew them by no other denomination than that of *Chèvre sauvage*. It is to be presumed, in fact, that Buffon himself imagined that these two animals are not of a species different from that of the domestic goat.'

Pennant, in his 'Synopsis of Quadrupeds,' (Chester, 1771), considers the *Bouc estain*, or *Bouquetin* (*Capra Ibex* of Linnæus), to be 'the stock whence the tame species sprung.' In the third edition (London, 1773), in his account of the *Ægagrus*, or Caucasian goat, he says, 'Since the discovery of this species of goat, to it must be given the origin of the name, as there is the greatest conformity between its horns and those of the domestic kinds; unless we can suppose that the latter, from their way of life, have lost the knots, the great character of the Ibex, which I once supposed to be their only stock. I cannot help thinking, with Dr. Pallas, that they may be derived from both, especially as we are assured that an union between the *Ibex* and she-goats will produce a fruitful offspring; yet Mr. Guldenstaedt says that the mountaineers of Caucasus never have observed them to mix or couple with the common goats.' Kæmpfer is the authority quoted by Pennant for the allegation that the *Ibex* and she-goats will produce a fruitful offspring. In the margin, opposite to the commencement of the paragraph above quoted, are the words, 'This one stock of the tame goats.' In his 'British Zoology,' Pennant concludes the natural history of the goat with this sentence:—'The origin of the domestic goat may be derived from the *Steinboc*, *Ibex*, or wild goat, now found only in the Alps and in Crete, and also from the Caucasian goat, which inhabits the loftiest and most rude points of Caucasus, the inhospitable hills of Laar and Khorazan, in Persia, and, according to Monardus, is also found in Africa; it may likewise have formerly been a native of the Alps and of Crete.' This remains in the last edition (1812).*

Linnæus, in his 'Systema Naturæ,' (12th edition) gives the goat (*Capra Hircus*) an Oriental origin; but seems to consider it as a distinct species. He says of it, 'Habitat in Oriente in montosis Hircus et Capra cum Hœdo, victitans ramulis variis frondibusque arborum, lichenibus; hospitatur in Europa.' He does not mention the *Ægagrus*, but gives the *Ibex* (*Capra Ibex*) as a species.†

Paseng.

Ibex.

Gmelin (*Syst. Nat.*, ed. 13) gives *Ægagrus* as the first species of the genus *Capra*, and it is followed by *Hircus*. Cuvier, in both editions, considers the Paseng (*C. Ægagrus*) to be the parent-stock of all the varieties of the domestic goat. He adverts to the Paseng as inhabiting the mountains of Persia in troops, and to the Oriental bezoar as a concretion found in its intestines. [Bezoars, vol. iv.] Fischer speaks of the *Ægagrus* as being, without doubt, the parent of our domestic goat. Whilst upon this inquiry

* 'A History of British Quadrupeds,' by T. Bell, F.R.S., &c.; London, Van Voorst, 1837, 8vo.

* Pennant died in 1798.

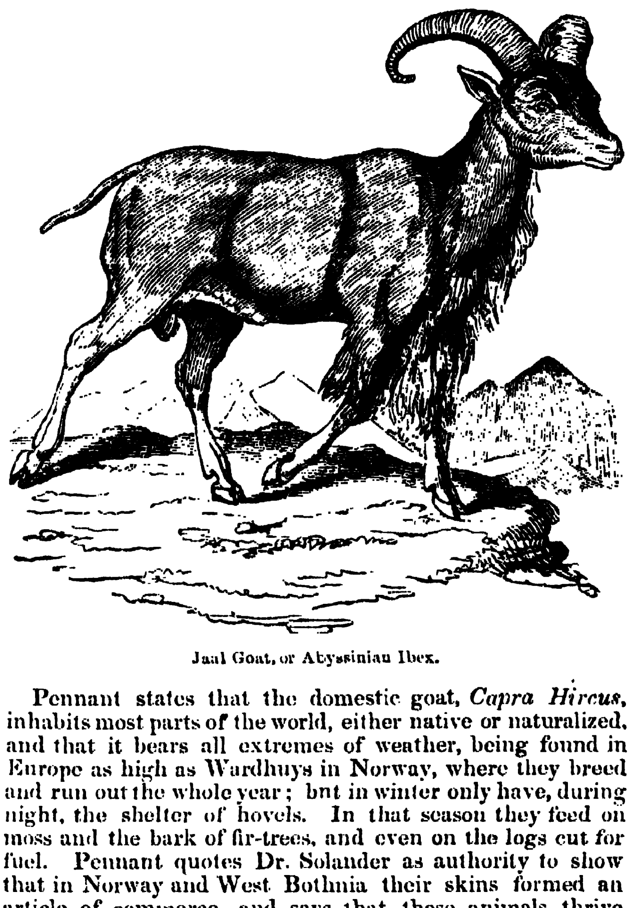
† Dr. Rengger mentions Capra Ægagrus in his catalogue of the mammalia of Paraguay. Quære tamen.

we must not omit the Jemlah goat (*Capra Jemlaica*, of Hamilton Smith), which is said to inhabit the district of Jemlah, between the sources of the Sargew and the Sampoo; that is, says Colonel Smith, the most elevated range of Central Asia, forming the nucleus between the western and south-eastern branches of the Himalaya mountains. Nor must we forget the *Jhâral* of the Nepalese, *Capra Jhâral*, described by Mr. Hodgson (*Zool. Proc.*, 1834), from a fine male specimen kept in his garden at Nepal. He states that the *Jhâral* is found wild in the Kachâr region, in small flocks, or solitarily, and gives its character as bold, capricious, wanton, eminently scansorial, pugnacious, and easily tamed and acclimatized in foreign parts. He remarks that the *Jhâral* has a close affinity, by the character of the horns, to the Alpine *Ægagri*, and still more nearly, in other respects, to *Capra Jemlaica*. It differs, he observes, from the former by the less volume of the horns, by their smooth anterior edge, and by the absence of the beard; from the latter, by the horns being much less compressed, not turned inwards at the points, nor nodose. He adds, that *Jhâral* breeds with the domestic goat, and more nearly resembles the ordinary types of the tame races than any wild species yet discovered.

'No animal,' says Pennant, 'seems so subject to varieties (the dog excepted) as the Goat;' nor did its multitudinous transfigurations escape Pliny (lib. viii., c. 53). Cuvier observes that the domestic goat, *Capra Hircus*, varies infinitely in stature, colour, length, and fineness of the hair, and in size and even number of the horns. The goats of Angora, in Cappadocia, with their soft and silky hair, and those of Thibet, whose delicate wool* is manufactured into the shawls (cachemires) so highly prized by the French beauties, are especially alluded to by him. To enumerate all the varieties would be to exceed our limits. The Angora goat, which inhabits the tract that surrounds Angora an Beibazar, in Asiatic Turkey, where the goatherds bestow much care on their flocks, frequently combing and washing them, loses, it appears, the delicacy of its hairy covering when exposed to a change of climate and pasture; and Pennant hints his suspicions that the design of the Baron Alstroemer, a patriotic Swede, who imported some into his own country to propagate the breed for the sake of their hair, turned out fruitless. A spirited attempt to acclimatize the Cashmere goat was made by an English gentleman, Mr. Towers, not long ago. The Cashmere goats, which lived some time in the gardens of the Zoological Society, and at the farm on Kingston-hill, certainly did not appear to have suffered in the fineness of their coats; but it is one thing to keep an imported individual by care and attention in the same state, and another to carry on the breed from generation to generation in its pristine beauty, under a different sky and on a strange pasture. We have indeed been informed that the flock of Mr. Towers amounted to about forty, and that the shawls made from the produce of their hides were excellent. One of these shawls was presented to Queen Adelaide. The importance of this manufacture to the people of Cashmere may be estimated from the alleged fact that sixteen thousand looms are there in constant work, each loom giving employment to three men, the annual sale being calculated at thirty thousand shawls. A preference is given to the wool of Thibet, and twenty-four pounds weight of the best of it is said to sell at Cashmere for twenty rupees. The wool is spun by women and coloured afterwards. It appears also from a book quoted in the 'Naturalist's Library' (Ruminantia, part 2, by Sir William Jardine), that a fine shawl, with a pattern all over it, takes nearly a year in making. The persons employed sit on a bench at the frame; sometimes four people at each, but if the shawl is a plain one only two. The borders are marked with wooden needles, there being a separate needle for each colour, and the rough part of the shawl is uppermost while it is in progress of manufacture. A Tartar half-breed, having been found to thrive well in a colder climate, has been introduced into France, not without success. The Cashmeres however which are brought from the kingdom of that name are the shawls in high request, and those who are curious in such articles should remember that there are in India several other goats besides the true Cashmere breed, whose wool is employed for the same purpose.

The *Syrian Goat*, with its excessively long ears, which is plentiful in the East, and, according to Pennant, supplies Aleppo with milk, is worthy of especial notice, as well as the *Dwarf African*, with its two hairy wattles under the chin, and the pretty little *Whidaw Goat*. Lieutenant-Colonel Sykes, in his Catalogue of the *Mammalia* obtained by him in Dukhun (Deccan), notices '*Capra Hircus*, Linn.: *Bukee*, of the Mahrattas. The goats in Dukhun are gaunt, stand high on their legs, have the sides much compressed, and are covered with long shaggy hair, which in most is black. Ears nearly pendent. Irides ochrey yellow or reddish yellow. Tail always carried erect in movement.'

The Jaal Goat, *Capra Jaela*, found in the mountains of Abyssinia, Upper Egypt, and Mount Sinai, is supposed by some to be the Akko (אקו) of Deuteronomy*, while others believe that animal to have been the *Ibex*. Mr. Ogilby suspects that the Saiga (*A. colus*), still called *Akkak* by the Tartars, and *Akim* by the Turks, is the animal meant [ANTELOPE, vol. iii., p. 73.]



Jaal Goat, or Abyssinian Ibex.

Pennant states that the domestic goat, *Capra Hircus*, inhabits most parts of the world, either native or naturalized, and that it bears all extremes of weather, being found in Europe as high as Wardhuys in Norway, where they breed and run out the whole year; but in winter only have, during night, the shelter of hovels. In that season they feed on moss and the bark of fir-trees, and even on the logs cut for fuel. Pennant quotes Dr. Solander as authority to show that in Norway and West Bothnia their skins formed an article of commerce, and says that these animals thrive equally well in the hottest part of Africa and in India and its islands. It is not, he adds, a native of the New World, having been introduced there first by the discoverers of that continent. In Britain the Domestic Goat is become comparatively rare, and even in its strong hold, Wales, it is no longer plentiful. In South Wales a goat is seldom seen, but there are still some wild ones in Glamorganshire. Their flourishing condition in the Principality at one time may be imagined from the size of the horns of the Cambria he-goat mentioned by Pennant: they were three feet two inches long, and measured three feet from tip to tip.

Utility to Man.—Few animals, when properly treated, are more useful to man; and though it never can answer to breed the goat in districts which will carry sheep, in rocky and woody countries it is invaluable. The manufactures from the hair have been alluded to. The pillow of goats' hair that supported the head of the image with which Michal deceived the messengers of Saul when he sought David's life† will occur to every one; and Pennant thinks that the variety which furnished it was the goat of Angora. In the days of wigs, the hair of the common domestic goats of this country was in high request, and the whitest were made of it. The best hair for this purpose was selected from

* This wool grows between the long hairs.

* Hircocervus, Deut. c. xiv., v. 5; Wilde Goate of Barker's edit., 1615; Wild Goat of modern editions.

† 1 Samuel, c. xix., v. 13—16.

that which grew on the haunches, where it is longest and thickest. In Pennant's time a good skin, well haired, was sold for a guinea, though a skin of bad hue, and so yellow as to baffle the barber's skill to bleach, did not fetch above eighteen pence or two shillings. Goats' hair is at present used in the manufacture of wigs for the dignitaries of the church and the members of the bar and the bench. The skin, particularly that of the kid, is of high importance to the glove manufacturer; it is also said to take a dye better than most others. The horns are useful for knife-handles; and the suet, it is alleged, makes candles far superior in whiteness and goodness to those made from that of the sheep or the ox, and, according to Pennant, brings a much greater price in the market. The flesh of the kid is good. 'The haunches of the goat,' writes the author last quoted, 'are frequently salted and dried, and supply all the uses of bacon; this by the natives is called *Côch yr wden*, or hung venison. The meat of a castrated goat of six or seven years old (which is called *Hyfr*) is reckoned the best; being generally very sweet and fat. This makes an excellent pasty, goes under the name of rock-venison, and is little inferior to that of the deer.' The medical properties of goats' milk and whey have been highly extolled, and the cheese is much valued in some mountainous countries.

Habits, Food, Reproduction, &c.—The odour of the goat, strong at all times, becomes insufferably powerful in the rutting season (from the beginning of September to November), but this pungent scent is not supposed to be unwholesome; and horses are said to be refreshed by it, whence the animal is frequently to be seen about stables. The female brings forth from the latter end of February to the latter end of April, after a gestation of four months and a half, generally two, but sometimes three, and even four young. The activity with which these animals will securely bound from rock to rock, and the unshaken firmness with which they will fix themselves on the edge of the highest precipices, are wonderful. Pennant says that when two are yoked together, as was frequently practised, they will, as if by consent, take large and hazardous leaps, and yet so time their mutual efforts as rarely to miscarry in the attempt. Nicholas Hasselgren, in his 'Swedish Pan' (Amœn. Acad.), states that goats eat 449 plants, and refuse 126. The same author states, that though they will eat greedily and safely long-leaved water-hemlock, monkshood kills them. Their favourite food consists of the tops, tendrils, and flowers of mountain shrubs, and of aromatic herbs; to this delicate diet was supposed to be owing the salubrity of the milk. The blood was supposed to have its healing properties also: that of a he-goat dried is mentioned by Pennant as a great recipe in some families for the pleurisy and inflammatory disorders, and is noticed in Dr. Mead's 'Monita Medica.' As an enemy to the vine, it was sacrificed to Bacchus; and the subject is prettily touched in many epigrams and verses, both Greek and Latin. The elegant lines of Ovid beginning 'Rode caper vitem' are familiar to scholars. In that dark and melancholy time when modern witchcraft was supposed to be rife, and when the very absurdity of the alleged facts seems to have sharpened the belief of the credulous and increased their eagerness to shed innocent blood, the goat figures not only as the conveyance on which the witches flew through the air to their diabolical festivals, but as the shape in which Satan himself often exhibited his person to his votaries.

Before we proceed to consider the place which has been assigned to the goat in the mammiferous series, it should be noticed, that there is no doubt that the domestic goat will breed with the sheep. M. F. Cuvier states, that the mule which is the result of the connexion participates in the nature of its parents, and is fruitful, but reproduces with difficulty. 'I have had,' says this zoologist, 'a similar female mule, which in its form inclined to the sheep, while it leant to the she-goat in its gait and in its hair ('par ses formes tenoit du mouton, et de la chèvre par ses allures et ses poils'); it did not couple till the third year with a goat, and was fruitful.' Upon this Mr. Bell remarks, that there is the same deficiency in the experiment as that which rendered the intermixture of the Ibex with the common goat above alluded to by him unsatisfactory.

We are indebted to the kindness of Mr. Ogilby for the following interesting information on the intermixture of the Cashmere goat with the sheep. During a visit to Rhenish Germany, in the autumn of 1837, that gentleman, whose attention has been particularly directed, as the zoological reader will have perceived, to the Ruminantia, learned from Professor Cretzschmar, the well-known editor of the mammalogical part of Dr. Rüppell's first 'Atlas,' the success of an experiment which the professor had been carrying on for some years in the neighbourhood of Frankfort on the Main, to ascertain the possibility of procuring a cross between the Cashmere goat and the Saxon Merino sheep. With this intention Professor Cretzschmar had, two or three years ago, procured a large Cashmere buck, which was put into a stable with twelve Merino ewes. For two seasons however his hopes were disappointed, and it was not till the season of 1836 that the desired union took place. During the spring of that year, the sheep very freely took the buck, and produced fine healthy lambs, which were, when Mr. Ogilby obtained his information, rather better than a year old: an examination of these Professor Cretzschmar undertook to procure for Mr. Ogilby, who, conceiving that the experiment might have a practical interest beyond that which would attach to it in the mere physiological or scientific point of view taken of it by Professor Cretzschmar, and that the wool of the hybrids might possibly be found to possess such improved qualities as would make it commercially important and an object of interest to the manufacturer, embraced the professor's offer; but being then on the point of starting for a distant part of the country, he was obliged to defer the examination till his return to Wiesbaden, upon which however he lost no time in repairing to Frankfort for that purpose. He there found that the animals in question had been bred on a farm belonging to Messrs. Bethmann, the well-known bankers, about a mile from the city, on the Saxenhausen side of the river, and within the territories of the free state of Frankfort. They were kept in a large stable with a number of pure Merinos, which is the usual mode of treating these valuable animals in that part of Germany, where the land is all under the plough, and there are neither sheep nor grazing farms; and so closely did they resemble the pure Saxon breed, that it was impossible to perceive any difference in their external characters. Even the owner, an intelligent and highly respectable gentleman farmer, though accustomed to see and handle them daily, could only distinguish between the pure and spurious breeds by examining the private marks on their ears; and had it not been for the notoriety of the circumstance, and the unquestionable respectability of the parties connected with the experiment, Mr. Ogilby confesses that he should have hesitated to believe it. The experiment however had been carried on, throughout its whole duration, under the immediate superintendence of Dr. Cretzschmar, who vouched for the facts here related. The most minute characters of their female parents, the Merinos, were reproduced in these young animals; the spiral horns, long tails, and spurious lachrymal sinus, or pit under the eye, were exactly those of the sheep, the pile of the wool, and even that peculiar quality which manufacturers call the 'yolk,' were in all respects those of the Merinos: the pelt was without any intermixture of long hairs, nor could Mr. Ogilby by the most minute examination discover the remotest approximation to any other character of the male parent. Mr. Ogilby procured specimens of the first clip, and of that growing on the backs of the hybrids, as well as of the pure Merinos brought up with them in the same stable, with a view of submitting them to the judgment of skilful wool-staplers in this country, but has not yet had an opportunity of doing so. Physiologically speaking, this experiment at present leaves the question of the fruitfulness of the hybrid progeny where it was: but we hope that the learned experimentalist will be induced to pursue the inquiry and ascertain whether these hybrids will be fruitful upon a connexion *inter se*: it is a curious fact that they should be so entirely free from any marks of the male parent and so completely similar to the mother.

Having called the attention of the reader to these facts, we would also refer him for the present to the papers of Bojanus* and Tillesius†: the first on the comparison of the skulls of the *Argali*, and of the domestic sheep and goat; the second on the *Argali*, considered as the parent of the

* 'Craniorum Argalidis, Ovis et Capræ Domesticæ Comparatio, Auctore Ludovico Bojano, A. C. N. C. Additis Tabulis duabus chalcographicis.'

† 'De Ægrocerote/Argalide Pallasii, ovis domesticæ matre, Brevis Disquisitio Gulielmi Theophili Tilesii, Dr. A. C. N. C. S., cum tabulâ lithographicâ.' Nova Acta Physico-Medica Academiæ Cæsareæ-Leopoldino Carolinæ Naturæ Curiosorum, Tom. xii., pars 1., Bonnæ, 1824.

domestic sheep; observing by the way that their contents will be more fully detailed in the article SHEEP. We shall now inquire as to the position assigned to the *goats* by some of the leading zoologists.

Ray established three genera of Ruminants with bisulcated hoofs. 1. *Bovinum genus*—the Oxen. 2. *Ovinum genus*—the Sheep. 3. *Caprinum genus*—the Goats, comprising the common *Goat*, the *Ibex*, the *Chamois*, the *Gazelles*, &c.

Klein's second family of quadrupeds consisted of those which have a divided horny-hoof. The type of the first genus was the *Ox;* of the second, the *Sheep;* of the third, the *Goat;* of the fourth, the *Stag;* and of the fifth, the *Hog*.

Brisson's fifth order consisted of those quadrupeds which have no incisor teeth in the upper jaw, but have eight in the lower jaw, and the hoof cloven. The first section consists of those which have simple horns; and comprises, as genera, the *Giraffe*, the *Goat*, the *Sheep*, and the *Ox*. The quadrupeds with branched horns, the *Stags*, follow.

Linnæus in his last edition (the 12th) makes *Capra* the fourth genus of his fifth order (*Pecora*), placing it between *Cervus* and *Ovis:* the genus contained the species *Hircus*, *Ibex*, *Mambrica* (Syrian goat), *Rupicapra* (chamois), &c., including some of the Antelopes and *Capra Ammon* (*Tragelaphus* and *Musimon* of Gesner).

Gmelin, in the 13th edition of the 'Systema Naturæ,' arranges the genus *Capra* under the same order, between *Antilope* and *Ovis*, to which latter genus he transfers the Musmon, *Capra Ammon* (Gmel., it.), of Linnæus, *Ovis Ammon* of Gmelin.

Pennant, in the first and third edition of his 'Synopsis,' placed the *Goats* between the *Sheep* and the *Giraffe*, the latter being followed by the *Antelopes:* in his 'British Zoology' the *Goats* are arranged between the *Sheep* and the *Deer*.

M. Lesson, in his 'Manuel' (1827), arranges the *Capridæ* (Les Caprées) between the *Bovidæ* (Les Bovinées) and the *Ovidæ* (Les Ovinées).

In both his editions of the 'Règne Animal' Cuvier gives the Goats, *Capra*, the same position under his *Ruminants à cornes creuses* (*Cavicornia*—hollow-horned Ruminants, or those whose horns have a bony core), viz. between *Antilope* and *Ovis*. The student should here refer to the elaborate work of Col. Hamilton Smith on the Ruminants generally and the *Cavicornia* in particular, published in Griffith's Cuvier. With regard to this valuable treatise Cuvier, in his last edition (1829) of the *Règne Animal*, thus expresses himself: 'The most complete work which has been produced on the Antelopes is that which M. Hamilton Smith has inserted in the English translation of this work, and I regret much that for want of sufficient subjects for observation, I have not been able to introduce here all the details.'

Fischer (1829) arranges the genus *Capra* (which he divides into two sections, 1, Barbatæ, *Capræ* of authors; 2, Imberbes, *Oves* of authors) between *Antilope* and *Bos*.

Mr. Gray places *Capra* among the *Bovidæ*. In his interesting *Spicilegia Zoologica* (1830), where he figures the female of the Nubian goat, the genus appears under that family. He had previously so arranged it in the *Annals of Philosophy* (1825); and Mr. W. S. MacLeay, in his paper 'On the Comparative Anatomy of certain Birds of Cuba' (*Linn. Trans.*), speaking of the mammalia, observes that the normal and aberrant groups were distinguished and named by Aristotle in his *Historia Animalium*, but had not, to his knowledge, appeared again in any work, until Mr. Gray had the honour of reviving them in the *Annals of Philosophy*. We have the best authority for stating that Mr. Gray still (1838) considers the *Goat* to belong to the family *Bovidæ*.*

Referring our readers to the works of MM. F. Cuvier, De Blainville, Desmarest, Desmoulins, Erxleben, Geoffroy, Hasselquist, Illiger,† Lichtenstein, Meyer, Schreber, Shaw, Zimmerman, and others, for their views on this subject, which, however interesting and desirable for the student, our limits will not permit us to dwell on here, we proceed to notice the personal observations of Mr. Hodgson in the 'Zoological Proceedings' (March, 1834).

Mr. Hodgson, in the memoir above alluded to, after remarking on the difficulty experienced by zoologists in the determination of distinctive marks adequate for the separation of the genera *Antilope*, *Capra*, and *Ovis*, insists that, as he has shown, the character founded on the presumed absence of cavities in the cores of the horns connected with the frontal sinus is incorrect, and he conceives that the value of the characters which are generally admitted by authors as distinguishing between the genera *Capra* and *Ovis* may be tested by a comparison of the wild race of either genus which belongs to the Himalaya. He then describes *Capra Jhâral*, above alluded to, which is 'clad in close short hair and without the least vestige of a beard,' as affined to the Alpine *Ægagri* and to *Capra Jemlaica*, and *Ovis Nahoor* (Hodgson) [SHEEP], placing them both under the tribe *Capridæ* (H. Smith); and having completed the description of this wild goat and wild sheep, he proceeds to exhibit the points of difference and of resemblance between the two in the following table:—

Goat.	*Sheep.*
Whole structure stronger and more compact.	Less so.
Limbs thicker and more rigid.	Feebler and more slender.
Hoofs higher and more compact.	Lower and less so.
False hoofs well developed.	Evanescent.
Head smaller and finer.	Longer and heavier.
Facial line straight.	Chaffron arched.
Ears shorter and rounded.	Longer and pointed.
Tail short, flat, nude below.	Longer, less depressed, and half nude only.
Withers higher than croup.	Croup higher.
Fore legs stronger than hind.	Fore and hind equal.
Croup sloped off.	Not so.
Odorous.	Not so.
Nose moister, with *nares* short and wide.	Less moist, longer, and narrower.
Horns of medial size, keeled, and turned upwards.	Horns very large, not keeled, and turned to the sides.
Eye darker and keener.	Paler and duller.
Hair long and unequal.	Short and equal.
Back arched.	Back straight.
Bears change of climate well.	Bears it ill.
Is eminently curious, capricious and confident.	Is incurious, staid, and timid.
Barks trees with its horns, feeding on the peel and on aromatic herbs.	Does not bark trees, and is less addicted to aromatics.
In fighting, rears itself on its hind legs, and lets the weight of its body fall on the adversary.	In fighting, runs a-tilt, adding the force of impulse to that of weight.

In describing the wild sheep, Mr. Hodgson observes that the horns are inserted high above the orbits on the crown of the forehead, touching nearly at the base with their whole depth, and carrying the frontal bones very high up between them, the parietals being depressed in an equal degree. The goat's skull has, he states, the same form but less strikingly developed; and he seems to think that this form of the skull would afford a just and general mark to separate *Ovis* and *Capra* from *Cervus* and *Antilope*, remarking that there is a gradation of characters in this respect among the *Antelopes* tending to the *Caprine* type in their general structure. Mr. Hodgson thus concludes 'The goat and sheep have in common hair and wool; no beard; no suborbital sinuses; evanescent muzzle; no inguinal pores; horns in contact at the top of the head; knees and sternum callous; angular and transversely wrinkled horns; striated ears; two teats only in the females; horns in both sexes; and, lastly, incisors of precisely the same form. Of the various diagnostics, then, proposed by Col. Hamilton Smith, it would seem that the following only can be perfectly relied on to separate *Ovis* from *Capra:*—slender limbs; longer pointed ears; chaffron arched; *nares* long and oblique; very voluminous horns, turned laterally with double flexures. I should add myself the strong and invariable distinction—males *not odorous*, as opposed to the males odorous of the genus *Capra*. But, after all, there are no physical distinctions at all equivalent to the moral ones so finely and truly delineated by Buffon, and which, notwithstanding what Col. H. Smith urges in favour of the courage and activity of *Sheep*, will for ever continue to be recognised as the only essential diagnostics of the two genera.'

Mr. Swainson ('Classification of Quadrupeds,' 1835) places 'the goats (*Capra*)' between the '*Bovidæ*, or bovine family' and 'the sheep (*Ovis*).'

In an interesting paper on the *Ruminantia* (*Zool. Proc.*, 1836) Mr. Ogilby, after observing (among other remarks) on the first introduction by Illiger of the consideration of the muzzle and lachrymal sinus into the definitions of the genera *Antilope*, *Capra*, and *Bos*, and the application of those principles by MM. Lichtenstein, De Blainville, Desmarest, and Hamilton Smith, in the subdivision of the artificial

* We omitted to mention in the article 'Giraffe' that Mr. Gray, in the paper above alluded to, places that animal in the family Bovidæ, and in the first section of it (Horns persistent). This section contains two subfamilies:—1. Bovina, including Bos, Ovis, Capra, Antilocapra, Antilope, Catoblepas; 2. Camelopardina, consisting of Camelopardalis.

† See post, col. 2.

genus Antilope into something more nearly approaching to natural groups (a reform but partial in its operation, and leaving the root of the evil untouched), makes *Capridæ*, which he places between *Moschidæ* and *Bovidæ*, the fourth family of the order Ruminantia. The following is Mr. Ogilby's character of the family *Capridæ*:—*Feet* bisulcated; *Horns* hollow, persistent; *Rhinaria* none; *Incisors* (dentes primores) none above, eight below: and he divides the family into seven genera, viz.: 1. *Mazama* (Type, *M. furcifer—Antilope furcifer*). [ANTELOPE, vol. ii., p. 71.] 2. *Madoqua* (Type, *M. Saltiana—Ant. Saltiana* et *Hemprichii*). [ANTELOPE, vol. ii., p. 74.] 3. *Antilope* (Type, *A. Cervicapra*). [ANTELOPE, vol. ii., p. 72.] 4. *Gazella* (Type, *Gazella Dorcas—Ant. Dorcas*). [ANTELOPE, vol. ii., p. 83.] 5. *Ovis* (Type, *Ovis Aries*). 6. *Capra* (Type, *Capra Hircus*). 7. *Ovibos* (Type, *Ovibos moschatus*).

The genus *Capra* is characterized as follows:—*Horns* in both sexes; *Lachrymal sinuses* none; *Interdigital Fossæ* small; *Inguinal Follicles* none; *Teats* two; and Mr. Ogilby adds, that *Ovis Tragelaphus** and *Antilope lanigera*, or *Americana* of authors, belong to this genus.

'I have,' writes Mr. Ogilby in conclusion, 'here confined myself strictly to generic characters; the synonyma and discrimination of species will form the subject of a future monograph: in the mean time, with the assistance of the article ANTELOPE, in the "Penny Cyclopædia," or, with the proper corrections, of Colonel Smith's Treatise on the Ruminants in the fourth volume of Griffith's translation of the "Règne Animal," the student will have no difficulty in referring any particular species to its appropriate genus. He will thus be enabled to judge of the correctness or incorrectness of the affinities here indicated, and consequently to form a tolerable estimate of the value of the characters by which I propose to distinguish the genera of ruminating animals; and indeed it is principally from the wish to excite the attention of zoologists to more extensive observation than I myself possess, that I have been induced to publish the present analysis of my own investigations in this department of mammalogy.

FOSSIL GOATS. (?)

Colonel Hamilton Smith some time since observed † that it is a fact of a singular nature, that as far as geological observations have extended no portions of the Caprine and Ovine races have been detected among the numerous fossil remains which have attracted the notice of comparative anatomists, notwithstanding the present wide geographical distribution of these ruminants. To this day we are not aware that any authenticated fossil remains of goats or sheep have been recorded. Of course it will be understood that such remains as those of the sheep found in Goat's Hole at Paviland, Glamorgan, were so associated and bore such marks as clearly to lead to the inference that they belonged to animals introduced for food, and that therefore they cannot be considered as fossil remains in the ordinary acceptation of the term. Dr. Buckland (*Reliquiæ Diluvianæ*) thinks that the date of the human female skeleton found in the same place belonged to the time of the military occupation of the adjacent summits, anterior to or coeval with the Roman invasion of this country.

As far then as our inquiries up to the present time have extended, we can find no evidence that true fossil bones of these animals have been found; but it should be remembered that negative evidence is inconclusive and dangerous.

GOATSUCKERS. [NIGHT JARS.]

GOBELIN, GILLES and JEAN, brothers, who introduced from Venice into France, in the reign of Francis I., the art of dyeing scarlet, and established extensive workshops for the purpose upon the small river Bièvres, in the Faubourg St. Marcel of Paris, at Gentilly. Here the brook takes the name Gobelins from the manufactory.

The project was considered at that time by the rival dyers of the metropolis to be so hazardous, that it was called *Folie Gobelin*; but by the brilliancy and solidity of the colours produced, the Parisians soon became astonished to such a degree that they said Gobelin had made a compact with the devil.

In the year 1677 Colbert purchased the dye-houses from the Gobelin family, in virtue of an edict of Louis XIV., styled it the *Hôtel Royal des Gobelins*, and established on the ground a great manufactory of tapestry, similar to that of Flanders. The celebrated painter Le Brun was appointed director-in-chief of the weaving and dyeing patterns. Under his administration were produced many magnificent pieces of tapestry, which have ever since been the admiration of the world; such as Alexander's battles, the four seasons, the four elements, and the history of the principal events in the reign of Louis XIV.

There is an academy within the Gobelins for the instruction of youth in the various branches of the fine arts, in physical science, and mechanics, subservient to the improvement of the manufacture.

GOBI, for which formerly the less correct expression Cobi was used, is a Mongolian term signifying 'desert,' and employed to indicate the immense tract of desert country which occupies nearly the middle of the high table-land of eastern Asia, and extends from the neighbourhood of Yarkand and Khotan, or from about 80° E. long. on the west, to the Kingkhan Oöla, or about 120° E. long. on the east. But a portion of this desert extends east of the Kingkhan Oöla to the northern boundary of the Chinese province of Leao-tong, more than five degrees farther east. The Gobi lies between 35° and 45° N. lat., on the west being nearer to 35°, and on the east nearer to 45°. Its mean width may be between 350 and 400 miles, and its length perhaps not less than 1800 miles.

That portion of the desert which is partly included in the Chinese province of Kan-si seems to contain the least sterile part of it; and between the towns of Hami and Shat-shew (sand-town) the desert probably is not much more than 200 miles across. That portion of the Gobi which extends west of the province of Kan-si, and is called Shashin or Kan-hai, is considered the worst part; its surface consists of loose sand, which is sometimes raised by the winds into the air, and moves along the ground like a body of water. This country is drained by the river Yarkand, which runs nearly 1000 miles and falls into the lake of Lop, which is of considerable extent, but does not communicate with the sea. On the north side of the river are some more fertile tracts, but on the south nothing but a sandy desert. That portion of the Gobi which extends east of the province of Kan-si is called Ta-Gobi (the Great Gobi), and is somewhat better known than the Western Gobi. The central part of it is a valley of an uneven surface, extending east and west, and from 150 to 250 miles across. Its lowest part is from 2600 to 3000 feet above the sea-level, and is covered with gravel and small stones; whence it has received from the Chinese the name of Shamo (sea of sand). In this valley only a few tracts of moderate extent are covered with a scanty vegetation. The soil is mostly impregnated with different kinds of salt, and the lakes, which are numerous, are salt, or at least brackish. To the north and south of this valley are mountainous tracts of country, which on an average may be from 100 to 150 miles across. They are partly wooded, and contain in many places excellent pasture-ground. Into those districts which border on the plain of northern China agriculture has been introduced, but it is mostly limited to the cultivation of millet; little wheat and barley is grown. The northern mountain-district contains the Kerloon, which, after a course of more than 500 miles, falls into the lake Dalai Noor, but issues again from it under the name of Argun, forming the boundary between the Russian province of Nertshinsk and Mantchuria, until it empties itself into the Amur.

The climate of the Gobi is extremely cold. The winter lasts more than nine months; and even in July and August snow falls, and it frequently freezes in the night. It is however observed that the frost does not stop the growth of plants. The Eastern Gobi is occupied by different tribes of the Mongolian race, who have numerous herds of camels (but only the Bactrian), horses, and sheep: in the more mountainous districts there are also black cattle, but they are not numerous. In the Western Gobi are some nomadic tribes of the Turkish-Tartar race. (Du Halde, *History of China*; Timkowski's *Travels*.)

GO'BIO, a genus of fishes belonging to the section Malacopterygii Abdominales and family Cyprinidæ. The species of this genus differ chiefly from the true Carps in having the anal and dorsal fins short and destitute of bony rays. The Common Gudgeon (*Gobio fluviatilis*, Ray) affords an example of this genus.

The Tenches (genus Tinca, Cuv.) may be here noticed,

* The Musmon is placed by the Prince of Musignano in the genus or subgenus *Capra*.
† Griffith's Cuvier.

since they possess most of the characters observable in the Gudgeons; their scales however are very small, and so are their barbules or cirri. One species only is found in this country, the Common Tench (*Tinca vulgaris*, Cuv.).

In the genus Cirrhinus, which comes next in Cuvier's arrangement, the dorsal fin is larger in proportion than in the Gudgeons, and the cirri are situated on the middle of the upper lip.

GODALMING. [SURREY.]

GODAVERY. [HINDUSTAN.]

GODEFROY. [GOTHOFREDUS.]

GODFREY of BOUILLON. [BOUILLON.]

GODFREY, THOMAS, was born in the city of Philadelphia, where he carried on the business of a glazier. His attention having been accidentally directed to the study of mathematics, he seems to have devoted himself to it with great ardour and perseverance; and in order that he might read the 'Principia' and other mathematical works written in Latin, instructed himself in that language. James Logan, who had some reputation as a mathematician, having treated him with kindness and lent him books, he presented to that gentleman in 1730 a paper describing an improvement of the quadrant. In 1732 Logan wrote a letter to Dr. Halley, in which he gave an account of Godfrey's invention, but no answer was returned. Meantime, in 1731, Mr. Hadley had communicated to the Royal Society of London a paper in which he described an improvement of the quadrant similar to that of Godfrey. The claims of both parties were afterwards investigated by the Royal Society, and it was decided that they were both entitled to the honour of the invention. The value of 200*l.* was sent to Godfrey by the Royal Society, not in money, but in furniture, on account of his intemperate habits. The instrument however is still known by the name of Hadley's quadrant. Dr. Benjamin Franklin says—'I continued to board with Godfrey, who lived in part of my house with his wife and children, and had one side of the shop for his glazier's business, though he worked but little, being always absorbed in mathematics.' He died in 1749.

Godfrey had a son, Thomas, who died in his 27th year. He wrote some poems, and is distinguished as the author of the first drama written by an American; it is a tragedy, called 'The Prince of Parthia.' (*Encyclopædia Americana.*)

GODIVA. [COVENTRY.]

GODMANCHESTER. [HUNTINGDONSHIRE.]

GODOLPHIN, SIDNEY GODOLPHIN, EARL OF, was a younger brother of a family said to have been settled at Godolphin, or, as it was antiently called, Godolcan, in Cornwall, before the Norman conquest. His father was Francis Godolphin, who was made a Knight of the Bath at the coronation of Charles II., 23rd April, 1661. We have not been able to discover the year in which the subject of the present notice was born, but he is said to have been very young when he was first introduced in (1645) to Charles II., then Prince of Wales, and acting as general of the royal army in the west of England. On the Restoration he was brought to court, and appointed one of the grooms of the bedchamber. The first political business in which we find him employed was the management of a confidential correspondence between the Duke of York (afterwards James II.) and the Prince of Orange (afterwards William III.) in the beginning of the year 1678, the object of which was to unite England and Holland in a war against France. (See Appendix to Sir John Dalrymple's *Memoirs of Great Britain and Ireland*, pp. 144—156.) The duke's anti-gallican zeal soon cooled, and the projected war never took place, but Godolphin's services were rewarded the following year by his appointment (26th March, 1679) as one of the Lords of the Treasury. In this office he soon acquired much reputation for ability and habits of business, and he also ingratiated himself so greatly with the king, that on the dismissal, in September, 1679, of the Duke of Monmouth and Lord Salisbury, he was, along with Lord Viscount Hyde (afterwards Earl of Rochester) and the Earl of Sunderland, entrusted with the chief management of affairs. Godolphin remained in power when Sunderland was dismissed in 1680, and went along with the king and the other ministers in the disgraceful secret negotiations entered into in 1683 with Louis XIV., for a renewal of the former dependent connexion of Charles with the French king. On the 14th April, 1684, he was transferred from his seat at the treasury-board to be one of the principal secretaries of state; but on the 9th September of the same year he was brought back to the treasury and placed at its head, having the day before been ennobled by the title of Baron Godolphin of Rialton, in the county of Cornwall. On the accession of James II., although his conduct in regard to the exclusion bill, a few years before, had not manifested much zeal for the interest of that prince, he was continued in office, but only in a subordinate place at the treasury-board. The letters of Barillon, the French ambassador, however, represent him as one of the chief of the confidential advisers of the new king, and as taking an active part in the negotiations which were immediately opened for continuing the same system of pecuniary obligation to France, and entire subserviency to that power, which had been established in the latter part of the preceding reign. (See Dalrymple's *Appendix*, part i., pp. 110, &c.; and Fox's *History of the Early Part of the Reign of James II.*) During this short reign he also held the office of chamberlain to the queen. After the Prince of Orange had landed in England, Godolphin was sent to negotiate with him on the part of King James, along with the Marquis of Halifax and the Earl of Nottingham; the commissioners submitted their proposals to his highness at Hungerford in Berkshire, on the 7th of December, and having received his answer returned with it to the king. Godolphin however had long been connected with the Prince of Orange, and on the establishment of the new government he was continued as one of the lords of the treasury, to the great grief, according to Tindal, of the Earl of Monmouth (afterwards Earl of Peterborough), the first lord, and Lord Delamere (afterwards Earl of Warrington), the Chancellor of the Exchequer, 'who soon saw,' says the historian, 'that the king considered him more than them both; for, as he understood the treasury business well, so his calm and cold way suited the king's temper.' He was left out of the new commission issued 18th March, 1690, when the king took an opportunity of dismissing Monmouth and Delamere; but this was merely a temporary arrangement, and on the 15th November following he was appointed first lord. He held this situation till May, 1697, when, in one of those adjustments by which King William was constantly modifying his cabinet with the view of preserving the balance of parties, he was replaced by Mr. Charles Montagu (afterwards Earl of Halifax). At this time Godolphin was looked upon as one of the tory party, and when a strong detachment of that party was brought into the ministry through the medium of the Earl of Rochester, in the end of the year 1700, he was recalled and again placed at the head of the treasury. He again went out with his friends about a year after, but his exclusion this time did not last long. The accession of Queen Anne in March, 1702, was immediately followed by the first exclusively tory administration that had existed since the Revolution; and on the 8th of May, Godolphin was made lord-high-treasurer, being the first person who had held that eminent office since the Restoration. He was in great part indebted for the importance which he now acquired to his intimate connexion with the Earl (afterwards the great Duke) of Marlborough, whose eldest daughter and successor in the dukedom afterwards married the son and heir of the lord-treasurer. The attachment of the queen to Marlborough's wife, the celebrated Duchess Sarah, opened for the duke at this moment the door to favour and power; but, as Tindal observes, neither Godolphin nor Marlborough himself would have obtained so great a share of the royal regard and confidence, if they had not been considered to be tories. 'The truth is,' adds the historian, 'both these lords had been educated in the persuasion that the tory party were the best friends to the constitution both of church and state; nor were they perfectly undeceived but by experience.'

Godolphin, who was created Viscount Rialton and Earl of Godolphin, 29th December, 1706, having also in 1704 been made a knight of the garter, continued to hold the office of lord-high-treasurer, and as such to take the chief part in the direction of affairs, till the interest of the Duke and Duchess of Marlborough was effectually supplanted by that of Mrs. Masham and Harley in 1710. From the first however both Marlborough and Godolphin had taken a moderate course, and the latter especially continued to approximate more and more towards the whigs, as that party acquired strength in the country and in the House of Commons. From about the beginning of the year 1706, Godolphin is to considered as having openly attached himself to the whig party. Soon after this a struggle

for the chief power commenced between him and Harley, which was put a stop to for a time by the queen's reluctant dismissal of the latter, on the distinct declaration of Godolphin and Marlborough that they would leave her service unless that step were taken, but the contest was not terminated by that ejection of one of the two rivals from the cabinet. Harley did not rest till, taking advantage of the ferment excited in the public mind in the summer of 1710, by the conduct of the ministry in the case of Sacheverel, he succeeded in emboldening the queen to venture upon the measure for which his intrigues had long given her a vehement inclination. The premier Godolphin was suddenly and rudely dismissed on the 8th of August: it is affirmed that the letter intimating the queen's commands was sent to him by the hands of a livery servant. He survived his loss of power about two years, having died on the 15th of September, 1712. Lord Godolphin left an only son, Francis, on whose death, without any surviving male issue, in 1766, the titles became extinct. A new barony however of Godolphin of Helston, which had been granted to this Francis in 1735, was inherited by Francis Godolphin, the son of his uncle Henry; but on his death in 1785 it also became extinct.

The administration of Lord Godolphin was made glorious by the victories of Marlborough, and he is also entitled to enduring gratitude and honour for several wise measures of domestic policy, especially the Union with Scotland, which was accomplished chiefly through his zealous exertions. 'Opposite opinions,' observes Tindal, 'have been delivered of his merit and character. Great abilities and integrity have been ascribed to him by some; while others have freely censured him for notorious defects in the latter, and allowed him to have been great only by the chance of place and distinction. He had concurred with the worst of king Charles II.'s ministers, and adhered to the last to king James. In these two reigns he gave no opposition: but the same active and passive obedience was not practised by him under king William. This was ascribed to his retaining principles very inconsistent with an entire approbation of his government; to which has been added a passionate admiration of and attachment to king James's queen. The higher esteem therefore seems due to his memory when we review his conduct in the fulness of his power. Alliances and the force of recommendations imposed upon him in some instances; but his great concern was to employ men of capacity and integrity, and such were sure of his kindest regards. Unbecoming instances of behaviour may be produced in the lives of great men of all ages and all employments. Had this been duly considered, such severe reproaches had not been cast upon this minister for his love of play and horse-races; by which indeed he became too much and too frequently engaged with the most worthless of men, gamesters and jockeys. But after all, when this objection is thoroughly examined, nothing will appear but a faulty choice of improper amusements; and there were no imputations upon him of any fraudulent practices, though such were then not unfamiliar to persons of his rank. Nor did his love for these diversions ever draw him off from the duties of his high station.' Elsewhere the same writer says, 'He was the most silent and modest man that was perhaps ever bred in a court. He had a clear apprehension, and despatched business with great method, and with so much temper that he had no personal enemies. He loved gaming beyond what men of business usually do, and gave one reason for it—because it delivered him from much talking. He had true principles of religion and virtue, and was free from all vanity, and never heaped up wealth.' This character, with its strongly contrasted tints, taken along with its general tone of moderation and sobriety, is altogether not a little curious, and difficult to be conceived at the present day. But business and pleasure were not such distinct walks in the beginning of the last century as they now are.

GODOONOFF, BORIS, tzar of Moscow, was born in 1552, of a noble family of Tartar descent. Having married the daughter of Maloota Skooratoff, a favorite of the tyrant of Moscow, tzar Ivan Vassilevich the Terrible, he was attached to the court of the tzar at the age of 22, where he soon distinguished himself by such prudent conduct that, although in favour with the tyrant, he avoided taking the least part in the cruelties which disgraced that reign, and of which his own father-in-law was the principal agent. The marriage of his sister Irene with the heir of the throne, Prince Fedor, in 1580, increased his influence, and, in 1582, he was nominated by Ivan Vassilevich one of the five members of the supreme council of state, and became the first favorite of Ivan's successor, Fedor, who threw all the burthen of the government upon him. He received the highest titles that a subject could attain, and such enormous estates that his fortune amounted to 150,000*l.* a year.

Fedor had no children, and his wretched state of health gave no prospects of his having any; but he had a brother called Demetrius, sprung from Ivan Vassilevich, by a seventh marriage, who was, at the time of his father's death, two years old. This infant prince was sent with his mother to the town of Uglich, where they lived in a kind of honourable exile.

Godoonoff ruled the empire in the name of Fedor with an absolute sway. The country was satisfied with the wisdom of his administration, and he conciliated the friendship of foreign powers. The court as well as the first officers of the empire were filled with his creatures, and all attempts to overthrow him were repressed and severely punished. Yet this grandeur was held by a very precarious tenure, the life of a monarch weak in mind and body. Godoonoff could expect nothing but an ignominious death on the accession of Demetrius, whose mother and relations were his sworn enemies; but he resolved to perpetrate a crime which released him from all danger, and paved the way to the throne. Assassins, hired by Godoonoff, murdered the young prince in 1591; but the inhabitants of Uglich, where the prince resided, rose against the assassins and massacred them. Godoonoff sent a commission composed of his own creatures to investigate this affair, who, after a mock examination, declared that the young prince committed suicide in a fit of madness, and that the individuals who were massacred by the inhabitants of Uglich as the murderers of the prince were innocent. The weak-minded Fedor, who blindly confided in his favourite, was satisfied with this report, and the public voice, which imputed this crime to Godoonoff, was silenced by the terror which he inspired, and which was increased by the punishment inflicted on those inhabitants of Uglich who had massacred his assassins. About two hundred of them were put to death, many had their tongues cut out, many were imprisoned, and the greatest number transported to Siberia, where the new town of Peleem was peopled with them. The antient city of Uglich, which had contained 30,000 inhabitants, became a deserted ruin. All those who had incurred any suspicion of having accused Godoonoff were punished in the most barbarous manner.

Godoonoff, however, was no less anxious to reward his adherents and to gain new ones, than to overawe his enemies. Whoever applied to him was sure of protection. Many who had deserved punishment were pardoned, and the documents which certified these acts of grace always declared that they were due to the intercession of Godoonoff: but his name never appeared in the decrees of condemnation, where it was always declared, that 'the punishment was ordered by the boyards —,' naming particular persons. His ambitious views were on the point of being frustrated by the pregnancy of the tzarina, who bore a daughter in 1592, but the infant princess died the following year.

Fedor died in the beginning of 1598, and with him ended the dynasty of Ruric in the direct line, although there were collateral branches which had become private families.

The tzar, by his last will, bequeathed the throne to his widow Irene, who was immediately proclaimed sovereign, but after a few days she retired to a convent, and declared her firm resolution to take the veil. When all entreaties that she would retract this resolution were fruitless, a universal acclamation proclaimed her brother Godoonoff as the only man capable of filling the vacant throne of Moscow. This movement was prepared by the adherents of Godoonoff, who laboured to produce that effect among the boyards, the clergy, and the people, while their chief remained with the widowed tzarina. A deputation, headed by the patriarch, proceeded to Godoonoff to announce his elevation to the throne, but he decidedly refused it, and remained unmoved by all their entreaties.

Upon this a general assembly of the states, composed of the principal persons among the nobility and clergy, as well as of the deputies from several towns, was convoked at Moscow six weeks after the death of Fedor, in order to elect a new monarch. The affairs of the state were in the meantime conducted by a council of boyards in the name of the tzar-

ma. Disobedience to the supreme government and disorders consequent on it manifested themselves in different towns. Every person feared the dangers of anarchy, and felt that he was the only man who could prevent them. These circumstances greatly favoured the elevation of Godoonoff. Fedor died in the beginning of 1598, and the assembly of the states, which met at Moscow on the 17th February in that year, unanimously proclaimed Godoonoff tzar of Moscow, and for two days public prayers were made that Godoonoff might be induced to accept the throne. On the 20th of February Godoonoff, who remained all this time with his sister at a convent in the environs of Moscow, was apprised by a deputation that he was elected sovereign by all the empire, but he still decidedly refused the proffered crown. On the second day the patriarch, accompanied by the principal clergy and nobility, entered the church of the convent which was surrounded by almost the whole population of Moscow. The patriarch, having performed divine service, requested Godoonoff to accept the throne, but, as he continued to refuse, the patriarch went to the cell of the widowed tzarina with several nobles and bishops, who prostrated themselves before her, while all the population assembled within and without the walls of the monastery did the same at a given signal, crying out that Boris should have mercy upon them and accept the throne. The patriarch with tears implored the tzarina to induce her brother to comply with their wishes. The tzarina, who had remained for some time inexorable, declared at last that, touched by the distress of the nation, she gave her benediction to her brother as the sovereign of Moscow. Godoonoff still continued to refuse, but when his sister positively insisted on his accepting the throne, he said, with an expression of the greatest humility, 'The will of God be done,' and seemed rather resigned to make a sacrifice than to accept the highest worldly dignity. The enthusiasm of the people was beyond all bounds. Thus Godoonoff, having prepared his way to the throne by a crime, ascended it with the acclamations and the universal joy of the nation. But he fully justified the hopes of the people and proved himself worthy of the supreme power.

Before his coronation a rumour was circulated that the khan of Crimea was on the point of invading the country. Godoonoff instantly took the field with such an imposing force that the khan, instead of attacking him, sued for a continuance of peace. A new lustre was added to his reign by the final subjugation of Siberia, which was accomplished about that time.

Boris was particularly anxious to extend the relations of Moscow with foreign powers, and it was a favourite scheme of his to establish a matrimonial alliance between his own family and some reigning house of Europe. He accordingly directed his attention to Gustavus, son of Eric, the deposed king of Sweden, an accomplished prince, who, having long wandered in many countries of Europe, was then living at Thorn, in Polish Prussia. Gustavus was received with great honours; rich presents and extensive estates were given to him, the tzar intending to make him sovereign of Livonia and his son-in-law; but unwilling to become a tool of the Muscovite policy against Sweden, Gustavus soon fell into disgrace. His wealth was taken from him, and after having been imprisoned for some time and partly restored to favour, he was finally exiled to the town of Kashin (in the present government of Tver), where he occupied himself with chemical experiments till his death in 1607. Disappointed in this project, Godoonoff proposed an alliance between his daughter Xenia, a princess of great beauty, and the Duke John, brother of the king of Denmark and of the queen of James I. of Great Britain. This proposal was assented to by the king and by the duke, but the duke's premature death before the marriage again marred the ambitious schemes of Godoonoff.

Among the other relations of Godoonoff with foreign powers, we may mention his frequent but desultory negotiations with Austria about a league against the Turks. Some negotiations with Persia on the same subject had no more successful result, and an attempt to fix the dominion of Moscow in the Caucasian countries in 1604 also failed. There was a close connection with England during Godoonoff's reign, and Queen Elizabeth proposed to him, in 1603, a marriage between his son and a young English lady of rank, then only eleven years old. During this reign the merchants of Lübeck received commercial privileges from him equal to those of the English in Russia. Godoonoff, who was anxious to civilize Russia, conceived the plan of establishing universities, where the young Muscovites should be instructed in foreign languages and the sciences. For that purpose he sent to Germany a native of that country, named Cramer, in order to choose teachers for the intended schools. This project failed through the opposition of the clergy, who considered the measure as an innovation dangerous to religion. He sent however eighteen young men of noble families to be educated in Germany, England, and France. He was also anxious to attract all foreigners who could promote the civilization of his country, such as physicians, engineers, and artificers. He was fond of conversing with foreigners, and had great confidence in them, which was fully justified by the conduct of his foreign guards, who remained faithful to his family to the last. He introduced many wise measures of administration, and never committed any unnecessary act of cruelty. In his policy he constantly leaned rather towards clemency than severity. The first two years of Godoonoff's reign were the most fortunate that Muscovy had ever witnessed; but untoward events soon followed. Some boyards were accused by their slaves of being ill disposed to the sovereign, who punished them by confining them in convents and exiling them to distant places. The bad harvests of 1601 and 1602 produced a general famine, the horrors of which, as described by eye-witnesses, seem almost incredible. Godoonoff exerted himself to alleviate this terrible calamity, and proved himself, in this emergency, the real father of the nation. This calamity produced a general disorganization, and bands of robbers infested all the country. Their chief, called Khlopko, rendered himself so formidable that it was necessary to send an army against him. He was defeated and taken in a regular battle not far from Moscow, in which the commander of the tzar's forces was killed. The robbers however continued to infest particularly the border provinces, and their number was increased by Fedor's ordinance establishing slavery. In 1604 a rumour began to be circulated that Prince Demetrius, who was believed to have been murdered at Uglich, was alive and making preparations in Poland to recover the throne of his ancestors. It is impossible to ascertain whether that celebrated character was really the Prince Demetrius or an impostor. However this may be, he found many partisans in Poland, levied an army, and entered Russia, where, after some reverses, he obtained complete success. Town after town submitted to him, and he was joined by the armies sent to oppose him. He was in full march on Moscow when Godoonoff suddenly died on the 13th April, 1605, under a strong suspicion of having destroyed himself by poison. If Godoonoff had not ascended the throne by a crime, he might be called one of the greatest princes recorded in history. In his abilities and vigour of character he resembled Peter I. His son Fedor, a youth of eighteen years of age, who is described as endowed with the most amiable qualities, received the oath of fidelity of all that part of the empire which was not under the domination of Demetrius. His reign was however of short duration, for on the 13th June a riot took place at Moscow; he was dragged with his family from the palace, and shut up in a house which was his private property, where he was murdered a few days afterwards. (Karamsin's *History of Russia*, vol. xi.; Mallet, *Histoire de Danemark*.)

GODSTOW. [OXFORDSHIRE.]

GODWIN, FRANCIS, son of Thomas Godwin, bishop of Bath and Wells, was born at Havington, in Northamptonshire, in 1561. He was elected student of Christ Church College, Oxford, in 1758, while his father was dean; became B.A. 158[illegible], M.A. 1583, B.D. 1593, and D.D. 1595. His earliest preferments were the rectory of Samford Orcais, in Somersetshire, and the vicarage of Weston in Zoyland, in the same county; he was also collated to the subdeanery of Exeter, in 1587. Afterwards, on the resignation of the vicarage of Weston, he became rector of Bishop's Lidiard. His favourite study was the ecclesiastical biography of his country, his collections for which he published in 1601, under the title of 'A Catalogue of the Bishops of England since the first planting of the Christian Religion in this Island; together with a brief history of their lives and memorable actions, as near as can be gathered from antiquity.' It was dedicated to Lord Bukhurst, who, being in high credit with Queen Elizabeth, immediately procured him the bishopric of Llandaff. He published another edi-

tion of this catalogue in 1615, with great additions; but partly in consequence of the errors of the press which it contained, and partly to please the king, he put it into a Latin dress in the following year, dedicating it to the king, who in return gave him the bishopric of Hereford, to which he was translated in 1617. The Latin Catalogue was reprinted, with a continuation to the time of publication, by Dr. William Richardson, fol., Cambr. 1743.

In 1616 Bishop Godwin published a folio volume, entitled 'Rerum Anglicarum Henrico VIII., Edwardo VI., et Maria Regnantibus Annales,' which his son Morgan Godwin translated and published in English, fol., 1630. Other editions of the Latin were 4to., Lond. 1628, and 12mo., Hag. 1653.

In 1630 he published a small treatise, entitled 'A Computation of the value of the Roman Sesterce and Attic Talent.' This was the latest of his productions. He died in the month of April, 1633.

Exclusive of the above-mentioned works he wrote two pieces of a different kind, one of which, in Latin, partook of a scientific character, entitled 'Nuncius Inanimatus in Utopia,' 8vo., 1629, the design of which was to communicate various methods of conveying intelligence secretly, speedily, and safely. It is supposed to have given rise to Bishop Wilkins's 'Mercury, or Secret and Swift Messenger.' The other was a posthumous work of imagination, written while he was a student of Christ Church, celebrated in its day, and even not yet forgotten, entitled 'The Man in the Moon, or a Discourse of a Voyage thither by Domingo Gonsales,' 8vo., 1638. To a later edition of this work, in 1657, a translation of the 'Nuncius Inanimatus' was appended by Dr. Thomas Smith, of Magdalen College, Oxford.

(*Biogr. Britan.*; Chalmers's *Biogr. Dict.*, vol. xvi., p. 58-61; Bliss's edit. of Wood's *Athenæ*, ii. 557, 558.)

GODWIN, WILLIAM, was born on the 3rd of March, 1756, at Wisbeach in Cambridgeshire, where his father had then the charge of a dissenting congregation. He was placed when eleven years old with a private tutor at Norwich; and when seventeen was sent to a dissenters' college at Hoxton, with a view to being educated for the ministry. In 1778 he became minister to a congregation in the neighbourhood of London, and continued to officiate in that capacity for five years. At the end of this period he removed to the metropolis, and henceforth sought subsistence by authorship.

The first work which Godwin published with his name was the well known treatise on 'Political Justice.' It appeared in the beginning of 1793, but sixteen months, as he states in his preface, after its composition was commenced. It appeared at a time when a panic had seized men's minds, and when the government, scared by the progress of events in France, were carrying on prosecutions against such as, by speech or writing, showed, or were thought to show, a disposition to sympathize with the French revolutionary principles. The freshness of tone pervading the treatise on 'Political Justice,' and the novelty and extravagance of many of its views, rendered it likely, under these circumstances, that the author would be exposed to danger; and in a characteristic passage of remarkable dignity, he thus commits his work to the public:—'It is now to be tried whether, in addition to these alarming encroachments upon our liberty, a book is to fall under the arm of the civil power, which, beside the advantage of having for one of its express objects the dissuading from tumult and violence, is by its very nature an appeal to men of study and reflection. It is to be tried whether an attempt shall be made to suppress the activity of mind, and put an end to the disquisitions of science. Respecting the event in a personal view, the author has formed his resolution. Whatever conduct his countrymen may pursue, they will not be able to shake his tranquillity. The duty he conceives himself most bound to discharge is the assisting the progress of truth; and if he suffer in any respect for such a proceeding, there is certainly no vicissitude that can befal him that can ever bring along with it a more satisfactory consolation.' (*Preface*, p. xi.)

The 'Political Justice' entailed no prosecution upon its author, but it brought much obloquy. Obloquy, displeasing in itself, is however a sure path to notoriety, which, whatever may be its origin or character, is pleasing. The 'Political Justice' imparted to Godwin a great notoriety; and he now rose, as he himself expresses it, 'like a star upon his contemporaries.' (*Thoughts on Man*, p. 338.) In the year following its publication, he published his novel of 'Caleb Williams,' the ultimate object of which was an illustration of some of the views contained in the 'Political Justice,' and a realization in the person of Caleb of many complaints contained in the 'Political Justice' of the prevailing state of society, designed to work upon minds for which the disquisitional character of the latter treatise was unsuited. The success of Godwin as a novelist, added to his previous notoriety as a political writer, raised his fame to its height.

Towards the close of 1794 some of Godwin's chief friends, Holcroft, Horne Tooke, Thelwall, Hardy, and others, were arrested, and brought to trial on charges of high treason. Godwin had himself studiously kept aloof from those societies, which were then the chief object of fear to the government, and as being members of which his friends were arraigned; for however great, nay extravagant, might be the changes which he contemplated, he had always advocated a quiet and gradual mode of attaining them, and avowed himself, whether in writing or conversation, the enemy of revolution. But to his friends in danger he now tendered a valuable assistance. His 'Cursory Strictures' on the charge delivered by Judge Eyre to the jury, which were published instantly in the 'Morning Chronicle,' were thought at the time to have contributed greatly to the acquittal of the accused.

In 1797 he published the 'Enquirer,' a collection of essays on moral and literary subjects. It was in April of this year that he married Mary Wollstonecraft, having, in pursuance of the opinions which he then entertained, and in which she concurred, against the institution of marriage, previously cohabited with her for a period of six months. His wife died in childbed in September of the same year, leaving Godwin a daughter who now bears the name of Mrs. Shelly, and who has given proofs that she inherits the powers of her parents. In 1798 Godwin edited the posthumous works of his wife, and also published a small memoir of her which is eminently marked by genuine feeling, simplicity, and truth. 'This light was lent to me for a very short period,' are the words with which it concludes, 'and is now extinguished for ever.'

The novel of 'St. Leon' was published in 1799. In the course of the next year Godwin paid a visit to Ireland, residing, while in that country, principally with Curran. In 1801 he married a second time. His 'Life of Chaucer' appeared in 1803, and was followed, the next year, by a third novel, bearing the name of 'Fleetwood, or the New Man of Feeling.'

It was about this period of life that Godwin entered into business as a bookseller, and leaving the nobler and more pleasant paths of literature, employed himself for some time in the composition of school-books, which were published under the assumed named of Baldwin. He came forward however in 1808 with his 'Essay on Sepulchres, or a Proposal for erecting some Memorial of the Illustrious Dead in all ages on the spot where their Remains have been interred.' In 1816 he published his fourth novel, 'Mandeville.' In 1820 appeared his 'Treatise on Population,' in reply to Mr. Malthus, whose own 'Essay on Population' had been suggested by Godwin's views of the perfectibility of man, as expounded in the 'Political Justice' and the 'Enquirer.' He afterwards devoted himself for some time to his 'History of the Commonwealth of England,' the four volumes of which appeared successively between the years 1824 and 1828. In 1830, when now seventy-four years old, he published his fifth and last novel, entitled 'Cloudesley.' In 1831 he published a volume of essays under the title of 'Thoughts on Man,' and in 1834 his last work, the 'Lives of the Necromancers.'

Shortly after the accession of Lord Grey to power, Godwin was appointed to a situation in one of the public offices, which, in his declining years, supplied him with an assistance and a comfort that he needed. He died on the 7th of April, 1836, in the eighty-first year of his age.

The name of Godwin, as a writer, is chiefly known in connexion with the 'Treatise on Political Justice;' but his best title to fame is derived from his novels. He had neither reach nor precision of thought sufficient to form a good philosophical writer. But though deficient in power of reflection, he possessed a singular skill in observing, and in describing what he observed, which fitted him to portray character. The characters of Falkland, in 'Caleb Williams,' and of Mandeville, are great examples of his skill in this respect; and there are perhaps no novels (not even excepting Sir Walter Scott's) which interest so much as those of

Godwin. His 'Essays' do not deserve any very high praise, and are principally valuable by reason of the remarks interspersed throughout on the education of children, to which subject Godwin had given much thought.

Of Godwin, the man, it is difficult to speak in terms of too great admiration. A more honest and sincere votary of truth never existed. He was thoroughly self-dependent. Modest and unassuming in character, of quiet and unobtrusive manners, he had no brilliancy to command the admiration of society, but he earned the love of all who knew him.

GODWIN, MARY WOLLSTONECRAFT, the first wife of William Godwin, better known however by her maiden name of Wollstonecraft, was born on the 27th of April, 1759. At the time of her birth her father owned a small farm in Essex, from which he afterwards, in 1768, removed to another farm, near Beverley, in Yorkshire.* Mary Wollstonecraft's early years were thus spent in the country, and she had no better opportunities of education than were furnished by the day-schools of Beverley, where she resided from her tenth to her sixteenth year. When she had attained this age, her father, having entered into a commercial speculation, removed from Beverley to Hoxton, near London. While she resided at Hoxton, Godwin was a student in the Dissenters' College of that place, but they did not then meet.

Mary Wollstonecraft's early years were not passed happily. Her father appears to have been a man of no judgment in the management of a family, and of a most ungovernable temper. 'The despotism of her education,' says Mr. Godwin, in his unaffected and interesting memoir of his wife, 'cost her many a heart-ache. She was not formed to be the contented and unresisting subject of a despot; but I have heard her remark more than once, that when she felt she had done wrong, the reproof or chastisement of her mother, instead of being a terror to her, she found to be the only thing capable of reconciling her to herself. The blows of her father, on the contrary, which were the mere ebullitions of a passionate temper, instead of humbling her, roused her indignation.' A woman of exquisite sensibility, as well as of great energy of character, she was thus led early to think of quitting her parents and providing for herself. She went first to live as companion to a lady at Bath, and afterwards, in 1783, in concert with two sisters and also a friend for whom she had conceived an ardent attachment, she opened a day-school at Islington, which was very shortly removed to Newington Green. Mr. Godwin, who is well qualified to give an opinion, speaks in high terms of her pre-eminent fitness for the teaching of children; but the call of friendship having carried her for a time to Lisbon, and the school having been mismanaged in her absence, she found it necessary on her return to give up this plan of subsistence. She almost immediately obtained the situation of governess in the family of Lord Kingsborough.

Mary Wollstonecraft had by this time made an attempt in authorship. She had in 1786 written and published, in order to devote the profits to a work of charity, a pamphlet entitled 'Thoughts on the Education of Daughters.' On leaving Lord Kingsborough's family in 1787 she went to London, and entered into negotiations with Mr. Johnson, the publisher, with a view to supporting herself by authorship. The next three years of her life were accordingly spent in writing; and during that period she produced some small works of fiction, and translations and abridgements of several valuable works, for instance, Salzman's 'Elements of Morality,' and Lavater's 'Physiognomy,' and several articles in the 'Analytical Review.' The profits of her pen, which were more than she needed for her own subsistence, supplied aid to many members of her family. She helped to educate two younger sisters, put two of her brothers out in the world, and even greatly assisted her father, whose speculative habits had by this time brought him into embarrassments. Thus for three years did she proceed in a course of usefulness, but unattended by fame. Her answer however to Burke's 'Reflections on the French Revolution,' which was the first of the many answers that appeared, and her 'Vindication of the Rights of Woman,' which appeared in 1791, rapidly brought her into notice and notoriety.

In 1792 Mary Wollstonecraft went to Paris, and did not return to London till after an interval of three years. While in France she wrote her 'Moral and Historical View of the French Revolution;' and a visit to Norway on business in 1795 gave rise to her 'Letters from Norway.' Distress of mind, caused by a bitter disappointment to which an attachment formed in Paris had subjected her, led her at this period of her life to make two attempts at suicide. But it is a striking proof of her vigour of intellect that the 'Letters from Norway' were written at the time when her mental distress was at its height, and in the interval between her two attempts at self-destruction.

It was at the beginning of 1796 that Mary Wollstonecraft became acquainted with Godwin. The result of their acquaintance has been stated in the preceding article to have been first, in consequence of their own opinions on the subject of marriage, a cohabitation which lasted for about six months, and at the end of that period, in deference to the opinions of the world, a marriage. Mary Wollstonecraft Godwin died in child-bed on the 10th September, 1797, in her thirty-ninth year.

* According to another account, furnished by a correspondent, she was either born at Loddon, in Norfolk, or her father removed there soon after her birth, and practised in that place many years as a surgeon and apothecary.

GODWIT. [SCOLOPACIDÆ.]

GOES. [ZEELAND.]

GOETHE. [GÖTHE.]

GOGRA. [HINDUSTAN.]

GOGUET, ANTOINE YVES, born at Paris in 1716, followed the profession of the law, and became counsellor to the parliament of Paris. He applied himself closely to literature, and especially to historical studies. The result of his researches appeared in his work, 'Origine des Lois, des Arts, et des Sciences, chez les Anciens Peuples,' 3 vols. 4to., Paris, 1758. The first volume treats of the period from the Flood to the death of Jacob, and the author follows the progress of civilization among the Assyrians, Babylonians, Egyptians, Phœnicians, and the early Greeks. He investigates—1, their laws and forms of government; 2, the state of their arts and industry; 3, that of their sciences; 4, their commerce and navigation; 5, their military discipline and tactics; 6, their habits and manners. The author has done the most he could with the scanty materials within his reach. The second volume comprises the period from the death of Jacob to the establishment of monarchy among the Hebrews. In this part, besides the above-mentioned nations, the author introduces to view several people of Asia Minor, such as the Lydians and Phrygians, with the states of Greece and the people of Crete; and he follows throughout the same distribution of his subject-matter as in the first volume, into government, arts, sciences, &c. The third volume treats of the period from the establishment of the Jewish monarchy to the time of Cyrus, and upon the same plan as the other two. The work ends with several dissertations on antient measures and coins, on the astronomical periods of the Chaldæans, and on the antiquities of the Babylonians, Egyptians, and Chinese. Goguet died soon after the publication of his work, leaving part of the materials of another, on the origin and progress of the laws, arts, and sciences in France, from the establishment of the monarchy.

GOITRE. [BRONCHOCELE.]

GOJAM. [ABYSSINIA.]

GOLCONDA. [HINDUSTAN.]

GÖCKING. [GERMANY, *Language and Literature.*]

GOLD is a metal which has been known from the remotest antiquity, and has been universally employed as a medium of exchange. Although the quantity of gold which is found, when compared with that of other metals, is small, yet it occurs in greater or less abundance in almost every part of the globe. It occurs in the native state, and combined with silver, and frequently mixed with metallic sulphurets and arseniurets. It is indeed stated by Gahn that but little sulphuret of iron is met with which does not contain some gold. The greatest quantity of gold is the produce of South America; the richest mines of Europe are those in Hungary; it has been found also in the sand of the Rhône, the Rhine, and the Danube; small quantities are occasionally found in the stream tin-works of Cornwall; and in Wicklow in Ireland, and the lead-hills of Scotland, no inconsiderable portions have been from time to time collected.

The greatest discovery of gold which has been made within a few years is that of its existence in the Uralian mountains of Siberia, accompanied by platinum; in the mine Zarewo-Alexandrowsk, in the year 1826, one piece of native gold was found weighing about twenty-three pounds,

with other pieces weighing from two to four pounds each. It is also found in a considerable tract of country in North and South Carolina, and in the other adjoining Atlantic States of the North American Union.

Native gold occurs crystallized, capillary, and massive; the primary form is a cube. It gives no cleavage; fracture hackly; hardness 2·5 to 3·0; colour yellow, of various shades; streak shining, opaque; specific gravity 17 to 19.

Gold not unfrequently occurs alloyed with silver, and this compound, where the quantity of silver is considerable, is known by the name of *electrum*. Electrum analyzed by Klaproth was found to consist of 64 of gold and 36 of silver, which are almost exactly in the proportions of one equivalent of each metal. Boussingault, who has since examined electrum from various parts of Columbia, found it to consist of very different proportions of the metals, but they were all definite compounds. Gold is separated from the various substances with which it is mixed by the process of amalgamation; this consists in combining it with mercury, and heating the amalgam formed, so as to distil the mercury which is thus repeatedly used for the same purpose.

Gold is of a fine yellow colour, and is susceptible of a high degree of polish. It is nearly as soft as lead; its specific gravity is 19·3; it is so exceedingly malleable that one grain may be extended over fifty-six square inches of surface, and gold leaf is only about $\frac{1}{200000}$ of an inch in thickness; some authors say $\frac{1}{280000}$ of an inch. Gold is also exceedingly ductile; a single grain may be drawn out into 500 feet of wire: in point of tenacity it is inferior to iron, copper, platinum, and silver; a wire 0·787 of a line in diameter is capable of supporting about 150 pounds. Gold suffers no change by exposure to air or moisture, even when heated. It melts at about 2016 of Fahr., according to Daniell's pyrometer; when in fusion it appears of a brilliant green colour. It is scarcely at all volatile, and may be long kept in fusion in a furnace without losing weight; but when it is melted by the heat of a lens a plate of silver held over it at some inches distance becomes gilt by its vapour. It contracts more than any other metal on cooling, and crystallizes in octohedrons.

We shall now describe the more important compounds of gold. Oxygen and gold unite, but not by direct action; it has indeed been stated that gold may be oxidized by the electric spark in atmospheric air, but this is denied by Berzelius.

Oxide, or Protoxide, of Gold is prepared by adding a solution of potash to one of protochloride of gold; a green powder is separated, which is the protoxide in question; it must be washed and dried at a temperature not exceeding 100° Fahr.; if the heat exceed this it is converted into metallic gold and peroxide; indeed this change is stated by some authors to occur at almost any temperature; it is, at any rate, an extremely unstable compound. It consists of

One equivalent of oxygen	8
One equivalent of gold	200
Equivalent	208

Peroxide, or Teroxide, of Gold is best obtained, according to Pelletier, by decomposing solution of perchloride of gold by digesting it with a slight excess of magnesia; the peroxide of gold precipitates in combination with the magnesia; after being washed the precipitate is treated with dilute nitric acid, which dissolves the magnesia and a little of the peroxide of gold, but leaves the greater part unacted upon; it is a hydrate of a bright reddish-yellow colour; but when concentrated nitric acid is used instead of dilute, the oxide is anhydrous, and nearly black. This oxide is decomposed by exposure to day-light, and by it its oxygen is very readily expelled. This oxide is with difficulty soluble in any acid; thus, although sulphuric acid dissolves a small portion, it is precipitated by water. It appears indeed to possess rather the powers of an acid than a base, and has been called *auric acid*, and it combines with potash, soda, and barytes, to form salts, which have been termed *aurates*. This oxide consists of

Three equivalents of oxygen	24
One equivalent of gold	200
Equivalent	224

Neither azote nor hydrogen combines with gold.

Chlorine and Gold unite to form two compounds. The perchloride is most readily obtained; it may be formed either by digesting gold in an aqueous solution of chlorine, or treating it with nascent chlorine, derived from the mutual decomposition of nitric and hydrochloric acids, and called *aqua regia*.

Perchloride, or Terchloride, of Gold gives a yellow-coloured solution, which becomes nearly red by evaporation, owing to concentration and the expulsion of any excess of acid. Its taste is acrid and bitter; with excess of acid this salt crystallizes in long needle-form crystals of a bright yellow colour, which are unalterable in a dry atmosphere, but deliquesce in a moist one; on the contrary, when a neutral solution is evaporated until chlorine commences to be evolved, a deep ruby-coloured crystalline mass of perchloride of gold is obtained. Gold is precipitated in the metallic state from the perchloride even by the action of light; hydrogen, charcoal, phosphorus, and many metals, produce a similar effect; so also do the protosulphate of iron, &c. The skin is stained of a purple colour by this solution.

Perchloride of gold is composed of

Three equivalents of chlorine	108
One equivalent of gold	200
Equivalent	308

Protochloride of Gold is obtained by heating the perchloride to a heat of about 500° Fahr. in a porcelain vessel. If it be too strongly heated, gold is deposited; it is better therefore to heat it rather less, and to treat the residue with water, which dissolves the perchloride and leaves the protochloride, which is a colourless saline mass, unalterable in the air, but in contact with water gradually changes into metallic gold and perchloride: boiling water decomposes it instantly. In consists of

One equivalent of chlorine	36
One equivalent of gold	200
Equivalent	236

Bromide of Gold is procured by dissolving the metal in a mixture of hydrobromic and nitric acids. The solution yields by evaporation a deep red-coloured saline mass; sometimes it yields crystals. This salt has so intense a colour that one part of it tinges 5000 parts of water.

Sulphuret of Gold is prepared by passing hydrosulphuric acid gas into a solution of perchloride of gold; it is a black powder, which, when heated, readily separates into sulphur and gold. This sulphuret is soluble in the alkalis potash and soda, and prepared in a different mode it is employed in covering earthen vessels. It consists of

Three equivalents of sulphur	48
One equivalent of gold	200
Equivalent	248

Phosphuret of Gold may be obtained either by directly heating gold-leaf and phosphorus in a tube deprived of air, or by passing phosphuretted hydrogen gas into a solution of chloride of gold. As obtained by the first process it is a grey substance of a metallic lustre; when obtained by the second it is a brownish powder. When heated in the air it is decomposed. Its composition has not been determined.

Iodide of Gold.—Iodine and gold do not act upon each other even when heated together; but when a solution of iodide of potassium is mixed with one of chloride of gold, yellowish brown iodide of gold is precipitated, which is insoluble in cold water, dissolved by the alkaline solutions, and decomposed by heat; when boiled in water, to separate any excess of iodine, it probably consists of

One equivalent of iodine	126
One equivalent of gold	200
Equivalent	336

Having described the principal binary compounds which result from the union of gold with non-metallic elements, we shall mention the more important binary compounds which it forms with the metals, or the

Alloys of Gold.—Most metals are susceptible of combining with gold; but it is to be observed that nothing is known of the compounds which it forms with the metals of the alkalis and earths, as potassium, calcium, &c.

Arsenic and Gold.—This alloy is obtained by heating gold-leaf and arsenic; with the application of a gentle heat the vaporized arsenic combines with the gold; it is a very brittle grey metallic compound; it is readily decomposed by calcination, and the whole of the arsenic is expelled; $\frac{1}{12}$ of arsenic is sufficient to destroy the malleability of

gold without altering its appearance; $\frac{1}{240}$ renders it grey and brittle.

Tellurium and Gold, but mixed also with a considerable portion of lead, occur in combination, constituting three varieties known as—*graphic tellurium*, *yellow tellurium*, and *black tellurium*.

Antimony and Gold.—According to Hatchett gold loses its ductility by combining with $\frac{1}{1920}$ of its weight of antimony. It is prepared by fusing the metals together; it is of a pale colour and fine grained; when long calcined in an open crucible the antimony is entirely expelled.

Manganese and Gold.—This alloy is of a pale colour; breaks readily under the hammer, and exhibits a spongy coarse-grained fracture.

Zinc and Gold yield an alloy of a pale greenish colour like brass, and totally devoid of ductility.

Tin and Gold.—Colour very pale whitish yellow; bends readily when the bar is not more than one-eighth of an inch thick; but when passed between rollers breaks longitudinally into several pieces. The grain of the fracture is fine, inclining to an earthy appearance, and is of a pale yellowish-grey colour.

Iron and Gold form an alloy of a pale yellowish-grey colour; it is very ductile, and may be rolled from the thickness of three-quarters of an inch to that of a guinea.

Nickel and Gold.—This alloy is of a fine brass colour; it immediately breaks under the hammer, with a coarse-grained earthy fracture.

Cobalt and Gold.—A pale yellow alloy mixed with grey; it is brittle, and has a fine-grained earthy fracture.

Copper and Gold combine in all proportions, without altering the colour of the gold; the density is diminished, but the hardness is increased. The alloy employed for ordinary jewellery contains 23·6 per cent. of copper; this tarnishes by use owing to the oxidizement of the copper; the original colour is restored by treating with ammonia. Copper is used to alloy the gold of coin in order that it may be rendered sufficiently hard to stand the wear to which it is exposed; the amount of copper is 1 in 12. Its specific gravity is 17·157. Of this alloy 20 troy pounds are coined into 934 sovereigns and one half-sovereign.

Bismuth and Gold form a very brittle alloy. It is sufficient to alloy gold with $\frac{1}{1920}$ of bismuth to render it brittle. A compound of 8 bismuth and 92 gold is of a pale yellow colour and brittle.

Silver and Gold combine well; the resulting alloys are very ductile. A small quantity of silver renders gold pale; 5 parts to 100 are sufficient for this effect. This compound was used by the antients and called by them *electrum*; we have already mentioned the existence of several native alloys of these metals, and that they are always combined in definite proportions.

Lead and Gold.—This alloy is very brittle, even when the lead forms only $\frac{1}{1920}$ of the alloy; even the fumes of lead destroy the ductility of gold.

Mercury and Gold combine with great facility and yield a white alloy, usually called an *amalgam*, much used in gilding. [Gilding.] On account of the readiness with which these metals unite, mercury is used, as already noticed, for separating gold in the process called amalgamation.

Platinum and Gold combine in all proportions; these alloys are fusible. Platina readily destroys the colour of the gold; the presence of only 0·02 of platinum is recognised by the extraction of colour.

Salts of Gold in which the oxide is a base are obtained with great difficulty; indeed when the peroxide is dissolved in nitric, acetic, or sulphuric acid, they require to be concentrated, the oxide does not saturate the acids, and the solutions are all decomposed by water.

Salts of Gold in which the peroxide acts as an acid do not, except one of them, possess any remarkable properties; this peroxide of gold is soluble in potash and soda, but no very definite or crystallized compounds of them have been formed. Ammoniuret of gold, sometimes called aurate of ammonia, is formed when ammonia is added to a solution of perchloride of gold; water is decomposed, and peroxide of gold precipitated in combination with a portion of the ammonia: this substance is of a yellowish-brown colour; it is to be collected in a filter, washed with a little water, and dried at a temperature below 212°. When this substance is heated it explodes violently, the gold is reduced to the metallic state, water is formed by the union of the oxygen of the oxide of gold with the hydrogen of the ammonia, and azotic gas is given out. It probably consists of two equivalents of ammonia and one equivalent of peroxide of gold.

Some of the most permanent salts of gold are the double chlorides; thus the potassio-chloride of gold crystallizes in small hexagonal tables; it is however quickly efflorescent in the air. The sodio-chloride of gold crystallizes in long quadrilateral prisms which are not altered by exposure to the air. When heated it melts in its water of crystallization, and afterwards loses a little chlorine. It appears to be the most stable of all the salts of gold. It consists of 14·68 parts of chloride of sodium, 76·32 of perchloride of gold, and 9 of water. The hydrochlorate of ammonia, the chloride of lithium, barium, &c., form crystalline double salts with the chloride of gold.

There is a compound containing gold which has been long used for giving a red colour to glass, under the name of the *purple powder of Cassius*; according to Berzelius it is composed 28·35 gold, 64 of peroxide of tin, and 7·65 of water; other chemists have assigned a different constitution to this substance. It is of a fine purple colour, and may be prepared by adding a solution of perchloride of gold to a mixed solution of protochloride and perchloride of tin, or simply by putting tin-foil into a solution of gold.

The general properties of the solutions of gold are—protosulphate of iron precipitates metallic gold from the chloride; protonitrate of mercury gives a black precipitate, and so does the protochloride of tin; but a mixture of the proto- and perchloride, as already noticed, gives a purple precipitate. Hydrosulphuric acid throws down black sulphuret of gold; ammonia, as already noticed, throws down a yellowish-brown precipitate of fulminating gold, which an excess of the alkali redissolves. Many of the metals, phosphorus, and charcoal, precipitate metallic gold, as also do oxalic acid and tartrate of potash when heated.

GOLD-BEATING. [Gilding.]

GOLD COAST. [Coast, Gold.]

GOLD FISH. [Cyprinidæ.]

GOLDBERG. [Liegnitz.]

GOLDEN-CRESTED WREN. [Sylviadæ.]

GOLDEN FLEECE. [Argonauts.]

GOLDEN NUMBER, so called from its having been formerly written in gold letters in the almanacs, is the year of the cycle of nineteen years in which the current year falls. To find it, add one to the year of the Christian Æra, and divide by nineteen, the remainder is the golden number of the year: but if there be no remainder, then nineteen is the golden number. For the derivation and use of this number, see Periods of Revolution, Metonic Cycle.

GOLDEN RULE, a name given to the rule of three, from its universal use. [Proportion.]

GOLDFINCH, the common name for the well known and gaily plumaged songster, *Carduelis* of Gesner and others, *Fringilla Carduelis* of Linnæus, *Carduelis elegans* of Stephens, *Cardello* and *Cardellino* of the Italians, *Le Chardonneret* of the French, *Distelfink* (Thistlefinch), *Distelzeizig* of the Germans, *Gwas y Sierri* of the antient British.

Mr. Gould, in his 'Birds of Europe, states that this beautiful species, with one characterized by him from the Himalaya Mountains, *Carduelis caniceps*, and an undescribed species from China, should form, in his opinion, a restricted genus from which he would exclude the *Siskin* and several others which have hitherto been associated in the genus *Carduelis*: indeed the same ornithologist, in his 'Century of Birds from the Himalaya Mountains,' describes and figures a finch nearly allied to the *Aberdevine*, or *Siskin*, of Europe, under the name of *Carduelis spinoïdes*.

Mr. Gould characterizes the genus, as restricted by him in the 'Birds of Europe,' thus.—

Generic Character.—*Bill* conical, longer than deep, compressed anteriorly, and drawn to a very acute point; culmen of each mandible narrow; tomia of the upper mandible angulated at the base, and slightly sinuated. *Nostrils* basal, lateral, and hidden by incumbent bristles. *Wings* of mean length; the first quill-feather rather shorter than the second and third, which are nearly equal and the longest of all. *Tail* rather short and forked. *Legs* having the *tarsi* short; lateral toes of equal length. *Claws* curved and acute; hind-toe tolerably strong, with the sole broad.

Geographical Distribution, Habits, &c.—M. Temminck gives the geographical range of the Goldfinch as extending from the southern isles of the Archipelago to Siberia; and

he states it to be common in many parts of France and Germany, but a bird of passage only in Holland. In the British Islands it is a constant resident, and the Prince of Musignano notes it as very common and permanent in the neighbourhood of Rome, where it passes the summer in the mountains and the winter in the plains. Mr. Gould (*Birds of Europe*) says that the European continent appears to be the utmost range of the Goldfinch. 'It gives preference,' he adds, 'to high lands and mountainous districts during winter, particularly such as are wild and barren, and afford a plentiful supply of the thistle, plantain, &c., the seeds of which constitute its favourite food: at this period it is generally to be observed congregated in small flocks flying through the air and suddenly settling among its favourite food. When the spring advances and the trees display a verdant appearance, the Goldfinch separates in pairs, each male taking a mate, and quitting the wild and open country for woods, orchards, and gardens, and, on the Continent, for the rows of fruit-trees that border the road-side. As soon as the foliage becomes dense enough to conceal the nest, the task of incubation is commenced; the nest is placed in the fork of a branch, and is of the neatest construction, being composed of lichens, moss, and dried grasses, lined with hair, wool, and the seed-down of the willow and thistle; the eggs are four or five in number, of a bluish-white spotted over with dashes of brown towards the larger end.'

This bird is so familiar to most that a detailed description would be superfluous. The sexes are nearly alike, but the tints of the female are not so bright as those of the male. The young are clad in a comparatively simple plumage, in which brown predominates, till their first change, and are then the 'Branchers' of the London bird-catchers.

In captivity the Goldfinch is prized more for its beauty, docility, and affectionate disposition, than for its song. It is frequently taught to perform a number of tricks, and we have seen one, exhibited by a German master of legerdemain, go through its part with great accuracy, feigning death at the proper moment, and lying motionless though a train of powder laid round it was fired.

Pennant is of opinion that this bird is the Χρυσομῆτρις (*Chrysomētris*), or Χρυσομίτρις, of Aristotle.

The reader who is interested may consult the useful and amusing English translation of Bechstein,* for the mode of treatment in captivity and the proper methods of tuition. [FRINGILLIDÆ.]

HYBRIDS.

For an account of the mules bred from a hen *Canary* and a *Goldfinch*, see CANARY BIRD, vol. vi., p. 228.

GOLDO'NI, CARLO, was born at Venice in 1707, of a family originally from Modena. His grandfather, in whose house he was born, was a man of pleasure, fond of the company of musicians and comedians, and young Goldoni early showed a predilection for theatrical performances. He was sent by his father to different colleges, but he repeatedly interrupted his studies by running away with some company of strolling players. Having at last taken his degree of doctor of law in the university of Padua, he began practising at Venice as an advocate, but soon left it to resume his rambling life, and engaged himself to a company of actors as stage poet. After some years he left his companions in 1742, and began practising at Pisa as a lawyer with great success, but the appearance of another dramatic company made him give up his practice, and he engaged himself again as a stage-poet, in which situation he continued for the greater part of his life. From that time he aspired to the honour of being the reformer of the Italian stage. The Italian comedy had from its birth been deficient in originality; it was an imitation, first of the old classic drama, and afterwards of the romantic Spanish plays, and although a few clever writers, such as Machiavelli, Aretino, Bibbiena, Della Porta, and the younger Buonarroti, produced some good specimens both of the classic and the romantic styles, yet, generally speaking, the want of a national drama suited to modern Italian manners was felt, and the stage was given up either to dullness or licentiousness and absurdity. The melo-drama, or opera, introduced by Rinuccini tended to favour, under the shelter of musical attraction, all sorts of irregularities of plot and action, and it gradually drove the regular comedy from the stage. But there was another species of play which might be styled national, namely, the 'commedie dell' arte,' or 'à soggetto.' These plays were not written; a mere outline of the plot was sketched out, and the various characters being assigned to the actors, each filled up his own part as he chose, the dialogue being for the most part delivered extempore on the spur of the occasion, just like a conversation in private society. It might be called an improviso drama. The principal characters of these plays were fixed, and consisted chiefly of what the Italians called Maschere, because the actors who performed them wore masks; they were a sort of caricature representatives of the native humour and local peculiarities of the people of the various Italian states. Thus, Pantalone was the prototype of a Venetian tradesman, honourable and good-natured even to weakness, with much of the humour peculiar to his country; the Dottore was a Bolognese professor somewhat pedantic; Brighella, a sort of Italian Scapini, was an intriguing rogue of a servant; Harlequin, from Bergamo, was a curious compound of simplicity and waggery; Policinella, a Neapolitan clown, a licentious, pilfering, but humorous knave. Each of these spoke his native dialect, while the other dramatis personæ spoke the written Italian. These generally consisted of an amoroso, or lover, and his mistress, often a couple of each, besides subordinate female characters of pert, shrewd, intriguing servant-maids, with the generic names of Colombina, Smeraldina, Spilletta, &c. The attraction of these plays consisted in their wit and drollery, the quick repartee, the licentious double meaning, and also in the acting of the performers. A few clever actors here and there gave a peculiar zest to the play, and many of these unwritten performances had really considerable merit, but mediocrity was fatal to them, and in most cases these comedies degenerated into mere scurrility and low vulgarity. Goldoni determined to revive the use of regular comedy, and with this view he wrote a vast number of plays descriptive of the life and manners of his countrymen. He had a great fund of invention, a facility of writing, and was an attentive observer of men. He excels in painting the Venetians of his time, jovial, licentious, good-natured, and careless; several of his plays are entirely in the Venetian dialect, and are remarkable for raciness and fluency of diction. His Italian, on the contrary, is far from pure, and the expressions are at times mean. Goldoni, although himself an honourable man, had mixed during a great part of his life with very equivocal company, and the manners which he paints, though real, are not always the best; indeed, some of his scenes would not be tolerated on the English or even French stage. Being deficient in general information, whenever he has attempted to sketch foreign manners he has committed blunders. He often wrote in great hurry for bread, as he himself says, being bound to supply his company with a certain number of new plays annually, and at one time he wrote as many as sixteen in one year, a circumstance which may account for the great inequality observable in his compositions. But with all his faults Goldoni was certainly the restorer, if not the creator, of Italian comedy; his plays continue to be acted with applause; there is still a company in Italy which goes by his name, Compagnia Goldoni; and the best writers of comedy that Italy has produced since his death, such as De Rossi, Giraud, Nota, &c., are confessedly disciples of Goldoni. He retained the Maschere in many of his plays, but as subordinate characters. As for the old impromptu Commedie dell' Arte, specimens of it are still performed on some of the minor theatres of the Italian cities, to which the broad humour of policinella, harlequin, gianduja, girolamo, &c., attract numerous audiences, especially of the lower orders. In Goldoni's time the Commedie dell' Arte found a powerful defender in Carlo Gozzi, a writer of unquestionable though ill-regulated genius, who was Goldoni's great antagonist, and divided with him the applause of the Venetian public. He wrote some clever parodies of Goldoni's plays. This contest, which made great noise at the time, and is by no means devoid of interest for the history of the Italian mind, is noticed at some length by Ugoni, *Letteratura Italiana*, article 'Carlo Gozzi,' and also by Baretti in his 'Account of the Manners and Customs of Italy.' Baretti however was prejudiced against Goldoni, and is unjust towards him. (See an account of the Italian drama under the head ENGLISH DRAMA.)

Goldoni, after many years of a very laborious life, was still poor, when in 1761 he was invited to Paris by the

* 'Cage Birds: their Natural History, Management, Habits, Food, &c., &c., with notes by the Translator,' London, 8vo., Orr and Smith.

Italian comedians of that city. He there wrote a great number of plays, some of them in French, most of which met with great success. His 'Bourru Bienfaisant' remained a standard play on the French stage. Voltaire speaks of Goldoni with great praise, and paid him very flattering compliments at the time. Diderot borrowed the subject of his 'Natural Son' from one of Goldoni's plays. Goldoni having become known at the French court, was appointed teacher of Italian to the daughters of Louis XV., and after some years a pension of 3600 livres was given to him. He was living comfortably in his old age at Paris when the Revolution deprived him of his pension. The Convention however, on a motion of Chenier, in January, 1793, restored it to him, but he did not live to enjoy the boon, as he died a few days after. His widow was paid the arrears.

Goldoni published an edition of his plays in 18 vols. 8vo., Venice, 1761; but a complete edition of his works was published after his death in 44 vols. 8vo., Venice, 1794-5. Numerous choice selections of his best plays have been and still are published in Italy. He also wrote 'Memoirs of his Life,' in French, in 3 volumes.

GOLDSMITH, OLIVER, was born on the 10th of November, 1728, at a place called Pallas, in the parish of Forney and county of Longford, in Ireland. He was the fifth among seven children of the Rev. Charles Goldsmith, who had married early in life when without means adequate for the support of a family, and who obtained his first church preferment, the rectory of Kilkenny West, only in 1730, two years after the birth of Oliver. The future poet was accounted a dull child; and for this reason, as well as on account of the straightened circumstances of the father, it was at first intended to bring him up for a mercantile employment. He received the first rudiments of his education from a village schoolmaster. Afterwards, when by a fondness for rhyming and other manifestations of wit he had so far excited hope that an uncle and other relations offered to undertake the expenses necessary for his being sent to the university of Dublin, he was removed to a school at Athlone, and thence, after an interval of two years, to another at Edgworthtown. He entered at Trinity College, Dublin, as a sizar, in June, 1744. His career here was anything but distinguished. He did not obtain a scholarship, and having been very idle, extravagant, and occasionally insubordinate, he took his degree of B.A. two years after the regular time, in February, 1749. It is but fair to remark that a violent and injudicious tutor seems to have been partly responsible for the unsatisfactory nature of Goldsmith's college career.

Goldsmith's father was now dead. But his uncle, the Rev. Thomas Contarine, who had already borne the principal part of the expenses of his education, amply supplied the father's place. Yielding to his uncle's wishes, Goldsmith consented to enter the church, but on applying for orders was rejected by the bishop, for what reason it is not exactly known. He then obtained the situation of private tutor in the family of a neighbouring gentleman, and very shortly gave it up in disgust. His uncle Contarine now determined to prepare him for the profession of the law, and sent him off to London for the purpose of keeping his terms at the Temple. But stopping at Dublin on his way, he lost in gambling the sum wherewith he had been furnished for the expenses of his journey, and returned home penniless. The kindness of his uncle was not yet exhausted; and having forgiven him all his former offences, he sent him after a time to Edinburgh to study medicine. He arrived here towards the close of 1752; and having attended most of the medical professors, though without much assiduity, he proceeded, at the end of two years, to Leyden, for the professed purpose of completing his medical studies. He resided at Leyden about a year, studying chemistry under Gaubius, and anatomy under Albinus, and at the same time indulging greatly in dissipation.

From Leyden Goldsmith set out to make a tour of Europe on foot, having with him, as is said, only one clean shirt and no money, and trusting to his wits for support. The following passage in the 'Vicar of Wakefield' is supposed to describe his own travels: 'I had some knowledge of music, and now turned what was once my amusement into a present means of subsistence. Whenever I approached a peasant's house towards nightfall, I played one of my most merry tunes, and that procured me not only a lodging, but subsistence for the next day.' By means of this and other expedients he worked his way through Flanders, parts of France and Germany, Switzerland (where he composed part of the 'Traveller'), and the north of Italy. He remained six months at Padua, and if (which is doubtful) he ever took a medical degree, it is most probable that he took it here. Hearing, while in Italy, of the death of his uncle and benefactor, he immediately turned his steps towards England; and having expended about a year on his travels, landed at Dover in the autumn of 1756.

Arrived in London, he was first an usher in a school, and, being very speedily disgusted with this employment, next an apothecary's assistant. The liberality of an old schoolfellow, who accidentally discovered him, enabled him soon after to commence practice as a physician; and by the joint aid of medicine and literature he managed for some short time to earn a scanty subsistence. In 1758 he obtained an appointment, which might have turned out exceedingly lucrative, as physician to one of the factories in India; and some of his letters written at this time show that he was very eager to proceed in that capacity to the East. In order to meet the expenses of his outfit and voyage, he immediately drew up and published proposals for printing by subscription his 'Inquiry into the Present State of Polite Literature in Europe.' But he did not pass an examination which it was necessary for him to undergo before the College of Surgeons; and though he did not altogether give up his intentions of travelling eastward, he was thus prevented from availing himself of the appointment. He now fell back upon literature, and formed an engagement with Mr. Griffiths, the proprietor and publisher of the 'Monthly Review,' to write for that journal, receiving in return a handsome salary besides board and lodging. The engagement was to last for a year; but at the end of seven or eight months it was given up by mutual consent. He published his 'Present State of Literature in Europe' in 1759. In 1761, while under arrest, he wrote the 'Vicar of Wakefield,' for which Dr. Johnson succeeded in getting for him at once 60*l.*, but which was not published until some time afterwards. 'The Traveller' appeared in 1765, and in the same year his ballad of the 'Hermit.' In the meanwhile he had published several compilations, and done much other booksellers' work, for the purpose of immediate profit.

His comedy of the 'Good-natured Man' was brought out at Covent Garden in the beginning of 1768. It had been previously declined by Garrick, and did not meet with any very decided success, though Dr. Johnson pronounced it to be the best comedy which had appeared since 'The Provoked Husband.' In 1769 he published his 'Deserted Village;' and in the same year entered into engagements for writing his histories of Rome, Greece, and England. On the establishment of the Royal Academy of Painting, in 1770, Goldsmith was appointed professor of ancient history in the institution; but the appointment seems to have been no more than honorary. In 1773 he appeared a second time as a dramatic author, and now with very great success. Dr. Johnson said of 'She Stoops to Conquer' that 'he knew of no comedy for many years that has so much exhilarated an audience, that has answered so much the great end of comedy—making an audience merry.' One of his last publications was a 'History of the Earth and Animated Nature,' which appeared in 1774, and in which he had been engaged for two or three years. For this work he received the large sum of 850*l.*; but Goldsmith's money was ever given or gambled away as soon as it was received, and very shortly he was in as great embarrassment as before. In the spring of 1774 he was taken ill with a fever, which, aggravated by mental distress consequent on poverty, and also by a wrong treatment, which his physician could not dissuade him from pursuing, terminated fatally on the 4th of April. He died at the age of 45. His friends erected a monument to his memory in Westminster Abbey, for which a Latin inscription was written by Dr. Johnson.

The preceding brief sketch of Goldsmith's life speaks plainly enough as to his character. He was weakness itself. Not without amiable dispositions, for indeed few men have possessed more benevolence or stronger family affections, but he wanted the strength of purpose which can alone regulate them for good. At no period of his life did he resolutely pursue an object. Idle at the university, unwilling to settle down to any profession, and when he had made his choice, lazy and apathetic in its pursuit, he at last became an author, merely because authorship was necessary

for subsistence, and wrote only as often and as much as the pressure of his wants required. He was ever ready to yield to the impulse of the moment, and a piteous tale would so work upon his feelings, that for the relief of an applicant he often not only gave his all, but even involved himself in debt. His weakness also assumed, in a remarkable degree, the form of vanity, with instances of which failing the reader of Boswell's 'Life of Johnson' will be acquainted.

Of Goldsmith the author but little need be said. The humour of the 'Vicar of Wakefield,' the pathos of the 'Traveller,' and the 'Deserted Village,' and the wit of some of his smaller poems, are known and appreciated by all. His numerous compilations, which were only written for money, are not proper objects of criticism. His histories of Greece and Rome certainly possess no critical value of any kind; and, yet they have long been read and probably will still continue to be read with pleasure by a large class who feel the charm of the writer's easy and lucid style, without caring or troubling themselves about the accuracy of his statements.

A life of Goldsmith was published not long after his death by Bishop Percy; and a memoir of him is to be found in Sir Walter Scott's 'Miscellaneous Prose Works.' A life in two vols. 8vo. has lately appeared, written by Mr. Prior, the biographer of Burke; a work to which neither novelty of matter nor attractiveness of manner gives a value proportioned to its bulk. Mr. Prior has also published an edition of Goldsmith's 'Miscellaneous Works,' in 4 vols. 8vo.

GO'LIUS, JAMES, was born at the Hague, in 1596. He was educated at the university of Leyden, where he studied the antient languages, mathematics, theology, and medicine, and made such great progress in his studies that he was appointed professor of Greek at Rochelle soon after he had attained his twenty-first year. He resigned this office after holding it a very short time, and returned to Leyden, where he devoted himself particularly to the study of Arabic under Erpenius. When the United Provinces sent an embassy to the king of Marocco, in 1622, Golius accompanied it by the advice of Erpenius, in order to obtain a more accurate knowledge of the Arabic language. He had already made sufficient proficiency in Arabic to present to the king of Marocco a memorial written in that language. In 1624 Golius was appointed professor of Arabic on the death of Erpenius, who had recommended him as the only person worthy to fill the chair. In the following year he sailed to the Levant, travelled in Arabia and Mesopotamia, and returned home by way of Constantinople in 1629. During his absence he was appointed professor of mathematics. He resided at Leyden for the remainder of his life, and died on the 28th of September, 1667. The work which has given most celebrity to the name of Golius is his 'Lexicon Arabico-Latinum,' published at Leyden, 1653, in folio. It was principally formed on the basis of the Arabic Lexicon of Jauhari, entitled '*Al Sihah*,' i. e. 'the purity,' and has been deservedly considered as a most extraordinary work for the time in which he lived. Many Arabic scholars prefer it to the new Lexicon by Professor Freytag of Bonn. Among the other principal works of Golius we may name 'Proverbia quædam Alis Imperatoris et Carmen Tograi,' Leyden, 1629, 8vo.; 'Ahmedis Arabsiadæ Vitæ et Rerum gestarum Timuri,' Leyden, 4to., 1636; and a reprint of the Arabic grammar of Erpenius, Leyden, 1656, with the addition of several Arabic works. He also compiled a Persian Lexicon, which was used by Castellus as the basis of the Persian Lexicon in his 'Lexicon Heptaglotton.' Further particulars concerning the works of Golius are given by Schnurrer in his 'Bibliotheca Arabica,' and by Silvestre de Sacy in the 'Biographie Universelle,' art. Golius.

GOLT, or GAULT, an argillaceous deposit, separating the upper green sand (also called fire-stone, malm-rock, &c.) from the lower green sand (also called Woburn-sand, iron-sand, &c.). In Kent, Sussex, Surrey, the Isle of Wight, Wiltshire, and Cambridgeshire, its geological situation and organic contents may be well studied. The clay of Specton on the Yorkshire coast unites the characters of golt and Kimmeridge clay. [CRETACEOUS GROUP.]

GOLTZIUS, HENRY, a celebrated engraver and painter, was born at Mulbrecht, in the duchy of Juliers, in 1558. He was first instructed by his father, who painted on glass, and afterwards studied design under Jacques Leonhard; but it was his own genius and application that raised him to the rank which he held among the best artists of his time.

He began as an engraver; and some of his earliest prints bear the date of 1578. One of them is a portrait of his father John Goltzius. Bartsch says he did not begin to paint till he was 42 years of age.

His first settlement was at Haarlem, where he married, and where he resided for a considerable time. He then travelled through several parts of Italy, and studied a long while at Rome, where he assumed the name of Henry Bracht to avoid interruption, till he thought himself capable of appearing to advantage as a painter. He was indefatigable in his attention to nature as well as the antique; and he made many designs after Raffaelle, Polydoro, and Michel Angelo. Late as he began it was incredible what a number of pictures he finished. Two of his best were his Danaë and a picture of the Crucifixion. History and portraits were his favourite subjects in both arts.

Goltzius's finest engraving, the Boy and Dog, bears the date of 1597. His two prints of the Hercules in the palace of the Belvedere were published immediately after his death, which happened January 1, 1617.

Goltzius was the founder of a school which had a fine and singular command of the graver. His immediate and most successful pupils were Mathan, Saenredam, and Muller.

GOMAR, FRANCIS, was born at Bruges, on the 30th of January, 1563. After spending some time at the universities of Strasburg and Heidelberg, he came to England in 1582, and continued his studies at Oxford and Cambridge, at the latter of which he took the degree of Bachelor of Divinity in 1584. In 1587 he was chosen pastor of the Flemish church at Frankfort, and in 1594 professor of divinity at Leyden. He is principally known as the opponent of Arminius, who was appointed as his colleague at Leyden in 1603. On the death of Arminius in 1609, and the appointment of Vorstius, who held similar theological doctrines, as his successor, Gomar retired to Middelburg, where he remained till 1614, when he was elected professor of divinity at Saumur. Four years afterwards he settled at Groningen as professor of Hebrew and divinity, at which place he remained till his death in 1641. He was present at the synod of Dort in 1618. His works were printed at Amsterdam in 1645. As he took the lead in opposition to Arminius, those persons who agreed with him in condemning the opinions of Arminius were called Gomarists, and also Anti-Remonstrants. They obtained the latter name from their opposition to the remonstrance which Arminius presented to the States-General in 1608. An account of the theological warfare between Gomar and Arminius is given under ARMINIUS.

GOMBROON, called also Bunder Abbas, is a town in Persia, situated at the entrance of the Gulf of Persia, opposite the far-famed island of Ormuz. The town once was flourishing, and carried on such an extensive trade that the English, French, and Dutch found it advantageous to maintain large factories here; but owing to some dispute among the natives, the factories were destroyed, and the place abandoned by Europeans, and its trade removed to Abushehr or Bushire. Before that event the town is said to have contained 30,000 inhabitants; now the population is reduced to 3000 or 4000 Arabs. It is surrounded by a mud-wall, about three-quarters of a mile in circumference. The houses are flat-roofed, but rather commodiously built; the streets, as in most Oriental towns, are narrow and dirty. The best building in the town is the palace of the sheïkh, which was formerly the Dutch factory, and has been converted into the residence of the Arabian chief. There is a good anchorage off the town, where a vessel may be perfectly sheltered. During the oppressive heat of summer, the inhabitants remove to the high mountains at the back of the town, on account of the unhealthiness of the place. The sheikh of Gombroon is dependent on the sultan of Muscat in Arabia. (Fraser's *Account of Persia;* Kempthorne, in *London Geogr. Journ.*, vol. v.)

GOMERA. [CANARIES.]

GÖMÖR. [HUNGARY.]

GOMPHOLITE, a name given by M. Brongniart to conglomerate rocks of the tertiary series, which in Switzerland are called Nägelflue.

GONDAR. [ABYSSINIA.]

GONDI. [RETZ, CARDINAL DE.]

GO'NDOLA is the name given to the pleasure-boats at Venice, which are very numerous, and serve as a substitute for the coaches and carriages of other cities. The town

being built on many little islands, divided by numerous canals, people of every condition are obliged to make frequent use of the gondola, in order to proceed from one district to another. The gondola is shallow, long, and narrow, pointed both at the head and stern, and rowed by two men. It is generally from 25 to 30 feet in length, and 5 feet in width in the middle, where a square cabin is constructed for the use of the passengers. The cabin is furnished with commodious seats, and has glazed windows and black curtains. By a law of the antient Republic, these cabins were uniformly covered with black cloth and hangings, and the gondolas themselves painted black, no distinction of ornaments being allowed, except with regard to the gondolas of foreign ambassadors on the occasion of public ceremonies. The gondolieri, or boatmen, formed an important body or corporation, amounting to several thousands: they were famed for their wit, often licentious, as well as for their skill and honesty. (Richard, *Description de l'Italie*, 1770, vol. ii.) Since the fall of the Republic, the number of gondolas has greatly diminished, owing to the decrease of the population and its reduced fortunes. Byron, in his 'Beppo,' st. 19 and 20, describes the singularly dark appearance of the gondola —'just like a coffin clapp'd in a canoe.'

GONFALO'NE, GUNTFANO'N, a word of Teutonic origin, derived from *gund*, which in the Frankish and Vandalic dialects meant 'war' or 'fight,' and *fano* or *fahne*, which in German means a 'flag' or 'standard;' the two together mean a 'flag of war.' (Wachter, *Glossarium Germanicum*, art. *Gund*: and Ducange, art. *Guntfano*.) Both the French and Italians of the middle ages adopted the word, and the latter corrupted it into gonfalone, and called the officer whose duty it was to carry the ensign 'Gonfaloniere.' We read of the gonfaloniere of the Holy Church, who was the commander-in-chief of the papal forces. [FARNESE.] The title of Gonfaloniere di Giustizia was given to a high magistrate of the Republic of Florence, appointed by the constitution of 1292. [DANTE.] The Republics of Siena and Lucca had also magistrates called gonfalonieri; and to this day, in the papal state, the chief municipal magistrate of each town is called Gonfaloniere, and is elected every year by the communal council, subject to the approval of the delegate, or political governor of the province. In the smaller communes or villages the corresponding magistrate is called Sindaco. (*Moto proprio di Leone XII. sulla Riforma dell' Amministrazione Pubblica*, 1824.)

GONG, a Chinese musical instrument of percussion, made of a mixed metal of copper and tin, in form much like the cover of a large culinary caldron, being circular, varying from about fifteen to twenty inches in diameter, and having a rim of from two to three inches in depth. It is struck by a kind of drum-stick, the head of which is of hard leather. The sound, or sounds of this instrument—for it produces many jarring ones simultaneously—can hardly be called musical, and in fact the gong, which is very powerful, is only used for the purpose of making sonorous signals, of marking time, and of adding to the clangor of the martial instruments used in war.

GO'NGORA (LUIS GONGORA Y ARGOTE), was born at Cordova in 1561. He was sent at the age of fifteen to Salamanca, to study law, which the love of poetry soon induced him to abandon. He wrote during his stay at that university the greater part of his jocose, amatory, and satirical pieces, which in language and versification are the best of his compositions. He had frequently to struggle with poverty, which evidently embittered his sarcastic muse. At last, in his forty-fifth year, he took holy orders, and obtained a scanty prebend in the cathedral of Cordova. He tried however to improve his prospects by going to Madrid, where, after eleven years of wearisome expectation, he was made one of the chaplains of Philip III., in whose court he found his talents fully appreciated. A sudden illness subsequently deprived him of his memory, and he returned to his native city, where he died on the 24th of May, 1627.

The disciples of the classic Spanish school were already tainted with the extravagant notions of the Italian Marinists, when Gongora unfortunately came with his vigorous mind, and as it were at the critical hour, to bring them into full fashion. He tortured the Spanish language without mercy, called his new phraseology *estilo culto*, and answered with intemperate abuse the judicious censure of his eminent contemporaries, the two brothers Argensolas, Lope de Vega, and Quevedo. On the other hand, the declining state and consequent wavering taste of his countrymen gave him what he desired, a crowd of admirers and imitators, who, with less talent, carried to excess the empty pomp and verbose obscurity of the artificial language and uncommon turn of thought of their dazzling model. They even split into two distinct although congenial schools: that of the *cultoristas*, the more zealous adherents of the pedantry of their master; and that of the *conceptistas*, the rivals of the Italian *concettisti*, who formed a set of still more conceited revellers in the wild regions of fancy. There are various compositions of Gongora still unpublished, but a Romancero under the title of 'Delicias del Parnaso' contains all his *romances* and *letrillas*.

The cultorista Alonso Castillo Solorzano extended Gongorism even to America, where he published his own works in Mexico in 1625.

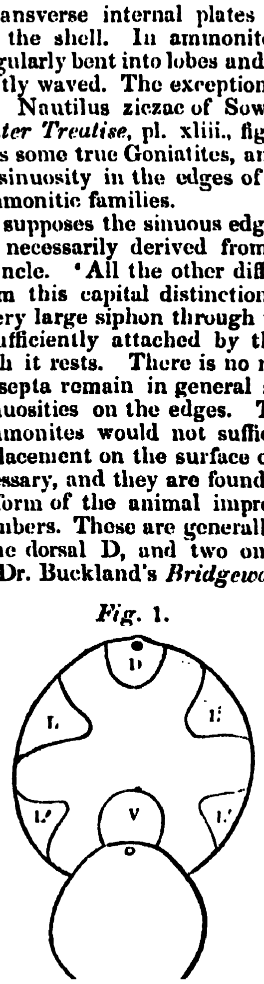
The earliest German romances were imitations of Göngora by Gleim.

GONIATITES, an extinct group of fossil shells, belonging to the division of Cephalopodous mollusca. The species which it contains are usually arranged, by writers on organic remains, as a section of ammonites; but their appropriate characters were never completely given till M. Von Buch, following Haan of Leyden, published his 'General Essay on the Sutures of Ammonites' (read to the Academy of Sciences at Berlin, in April, 1830; translated in the 'Annales des Sciences Naturelles,' 1833). The great importance justly attached to this group, in reasoning on the succession of organic life on the globe, induces us to present somewhat more than an outline of its structure and geological history.

The families or genera of nautili and ammonites are seldom well understood by the conchological student, because the real distinctions between them are not the most apparent. The most constant of all the characters of ammonites is the situation of the siphon, which, instead of perforating the disk of the transverse internal plates as in nautilus, touches and lies parallel to the inner face of the shell on the dorsal line. There is another obvious and generally complete distinction in the form of the sutures, or intersections of the transverse internal plates (septa) with the inner surface of the shell. In ammonites this suture is undulated, or angularly bent into lobes and sinuses; in nautilus, even or gently waved. The exceptions to this are few, but remarkable. Nautilus ziczac of Sowerby (Dr. Buckland's *Bridgewater Treatise*, pl. xliii., fig. 3) has sutures waved as much as some true Goniatites, and there is in fact every degree of sinuosity in the edges of the septa of the nautiloid and ammonitic families.

M. Von Buch supposes the sinuous edges of the septa of ammonites to be necessarily derived from the dorsal position of the siphuncle. 'All the other differences,' says he, 'are derived from this capital distinction. The nautilus, which passes a very large siphon through the middle of the septa, appears sufficiently attached by this membrane to the basis on which it rests. There is no need of any other support, and the septa remain in general smooth and concave without sinuosities on the edges. The small dorsal siphon of the ammonites would not suffice to secure the animal from displacement on the surface of its cell.' Other supports are necessary, and they are found in the marginal lobes which the form of the animal impresses on the partitions of the chambers. These are generally six in number; one ventral V, one dorsal D, and two on each side L, L' (See *fig.* 1; and Dr. Buckland's *Bridgewater Treatise*.)

Fig. 1.



M. Von Buch, viewing Goniatites as a section of ammo-

nites, presented the following characters of the group in 1830:—

The lobes of the septa are completely deprived of lateral denticulations or symmetrical crenatures, so that their contour presents always a continuous uninterrupted line. The siphon, compared to that of other ammonites, is small and delicate; the striæ of growth are sigmoidal on the sides (as in *fig.* 2), inflexed from the aperture on the back, so as to form a sinus there in the aperture, thus resembling nautili; whereas in ammonites generally the striæ advance along the dorsal line supported probably by the siphon. The last chamber of Goniatites extends, according to Count Munster, more than one turn beyond the concamerations, but in ammonites only three-fourths of a turn.

Later investigations have scarcely modified these fundamental views, except by showing a greater variety in the forms of the sutures than was at first expected.

Eighteen species of Goniatites are distributed by Von Buch in the following manner:—

1. Sutures with rounded lobes:—
   - *a*, dorsal lobe simple . . . 4 species
   - *b*, dorsal lobe double . . 1 „
2. Sutures with pointed lobes:—
   - *a*, dorsal lobe simple . . . 6 „
   - *b*, dorsal lobe double . . . 7 „

Count Munster (*Ann. des Sci. Nat.*, 1834) gives twenty-two ascertained and four doubtful species (mostly different from Von Buch's) from the Fichtelgebirge. His arrangement is different, viz.:—

1. With simple lobes slightly sinuous and rounded . . . . . 4 species
2. With angular or linguiform lobes:—
   - *a*, shell entirely involute, sutures with one lateral angular lobe . . 8 „
   - *b*, shell entirely involute, sutures with two lateral lobes . . . 4 „
   - *c*, shell evolute, three lateral lobes . 6 „

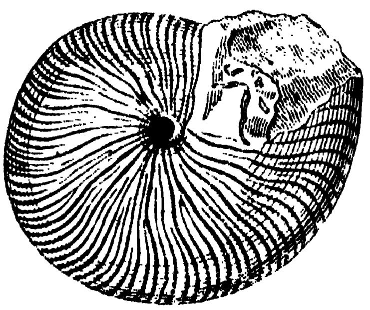
Doubtful species . . . . 4 „

Martin, in 'Petrificata Derbiensia,' 1809, figured two species of Goniatites; Sowerby, in the 'Mineral Conchology of Great Britain,' added two others; and Professor Phillips, in the 2nd vol. of the 'Illustrations of the Geology of Yorkshire,' 1836, has raised the number of British species from the carboniferous limestone, millstone grit, and coal formations, to thirty-three species, the septa of which are completely ascertained.

Beyrich (*De Goniatitis in Montibus Rhenanis occurrentibus*, 1837) describes eighteen species (eight of them supposed to be new), and presents a general classification of all the Continental species supposed to be distinct, at that time known by the descriptions of Haan, Von Buch, Munster, Goldfuss, &c. They amount to forty-two. Of these only three or four are perfectly identical with those described in the 'Geology of Yorkshire,' and thus we have, as the total number of species really distinguished, seventy-one or seventy-two.

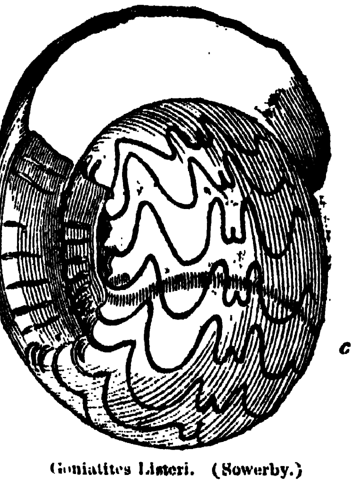
Variations of Structure.—In external form Goniatites present an almost complete series of gradations from the involute subglobular figure, common among nautili, to the discoid spiral shape of the flattest ammonites. The following figures, from Phillips's 'Geology of Yorkshire,' vol. ii. pl. 19 and 20, will illustrate this.

Fig. 2.



Goniatites truncatus. (Phillips.)

Fig. 3.

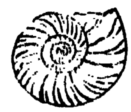


Goniatites Listeri. (Sowerby.)

Fig. 4.

Goniatites spirorbis. (Phillips.)

Fig. 5.



Goniatites Gibsoni. (Phillips.)

Most of the Goniatites have rounded backs; a few are carinated, as *G. vittiger* and *G. rotiformis*, Phillips.

In nearly all the Goniatites the surface is marked by transverse sigmoidally-bent lines of growth; a few have merely annular striæ; in some these striæ rise into tubercles on the inner edge of the whorls (*G. Listeri*, Sow.; *G. subnodosus*, Munst.). The striæ are occasionally reticulated by spiral lines. Radiating undulations occur on some of the flatter species; in a few (*G. Gibsoni*) there are ribs divided after the manner of many ammonites; and *G. binodosus*, Munster, has two rows of tubercles. In all these particulars the parallelism of the series of Goniatites to that of common ammonites is very remarkable.

This analogy with the usual forms of ammonites is augmented by the occurrence of constrictions on the cast of the interior of the shells (fig. 3, *c*). These constrictions, corresponding to internal thickenings of the shell, are most remarkable in the involute Goniatites. (See Phillips's *Geology of Yorkshire*, vol. ii., pl. xix., fig. 1, 2, 24, 26; pl. xx., fig. 1; Munster, in *Ann. des Sci. Nat.*, pl. v., fig. 2; and Beyrich, in his *Dissertation*, tab. ii., fig. 8.) They are parallel or nearly so to the lines of growth, and cross the sutures without any definite relation. They may be viewed as periodical thickenings of the edge of the aperture, and as contributing to strengthen the last chamber of the enlarging shell. They vary as to number and position in individuals of the same species. The aperture of many Goniatites resembles that of the recent Nautilus Pompilius.

The sutures of the Goniatites are extremely various, beautiful, and characteristic of the species. Individuals of several of the species have been compared almost from the nucleus to full growth without any great change being visible in the form of the septum (as for instance, *G. Listeri*), but in others this is not the case. The following arrangement and accompanying figures will show the principal variations of the sutures. The arrow is in each case supposed to point towards the aperture.

Division 1. The dorsal lobe simple; one lateral lobe.

- *a*, lateral lobe single and rounded. *G. expansus*, Von Buch, *fig.* 6.
- *b*, lateral lobe single and angular. *G. sublævis*, Munster, *fig.* 7.

Division 2. The dorsal lobe simple; more than one lateral lobe.

- *a*, lateral lobes linguiform, and nearly equal. *G. Henslowi*, Sowerby, *fig.* 8.
- *b*, lateral lobes rounded and nearly equal. *G. serpentinus*, Phillips, *fig.* 9.
- *c*, inner lateral lobes very much the largest. *G. Munsteri*, Von Buch, *fig.* 10.
- *d*, lateral lobes very unequal and oblique *G. Hæninghausi*, Von Buch, *fig.* 11.

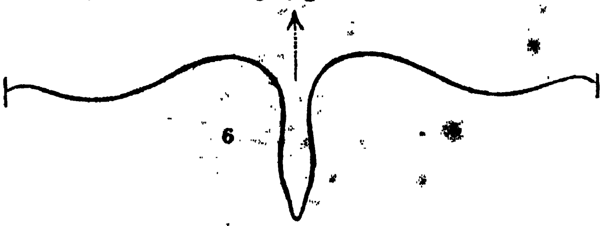
Division 3. Dorsal lobe divided; lateral lobe single.

a, lateral lobes and sinuses rounded. *G. bidorsalis*, Phillips, *fig.* 12.

b, lateral lobes and sinuses angular. *G. striatus*, Sowerby, *fig.* 13.

Division 4. Dorsal lobe divided or complicated; lateral lobes more than one.

G. cyclolobus, Phillips, *fig.* 14.



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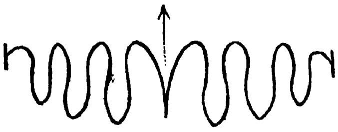
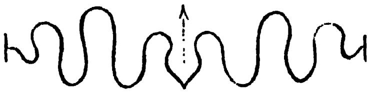
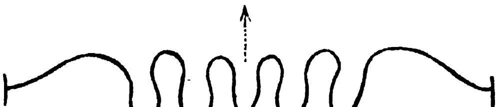
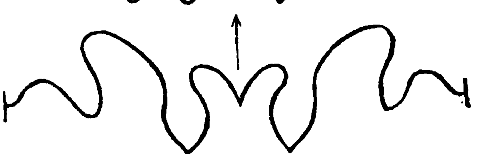
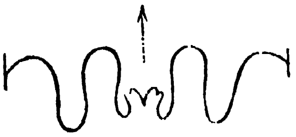
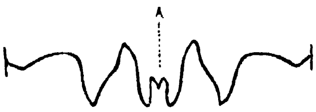
8 

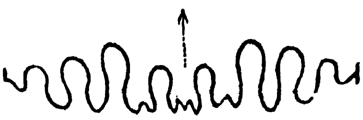
9 

10 

11 

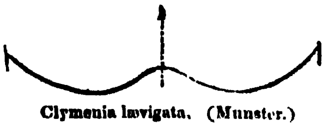
12 

13 

14 

Relation to other Genera.—The same transition rocks which contain a large portion of the Continental species of Goniatites yield a cognate group, from which they are with difficulty distinguished. These were first separated by Count Munster, under the name of Clymenia. If Goniatites are considered as of the ammonoid, Clymeniæ may be included in the nautiloid type. Their siphon is always on the *inner* margin, and the septa, instead of a *reflex* wave on the dorsal line, have there a bend *forward* toward the aperture. The Clymeniæ have all the same variations of form and surface which have been mentioned with regard to Goniatites. *Figs.* 15 to 18 represent the forms of septa of Clymeniæ, for comparison with those of Goniatites.

Fig. 15.

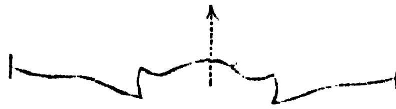


Clymenia lævigata. (Munster.)

Fig. 16.

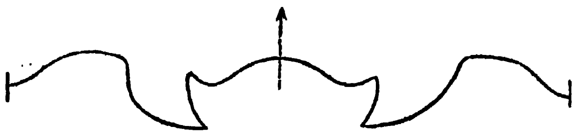
Clymenia compressa. (Munster.)

Fig. 17.



Clym. planorbiformis. (Munster.)

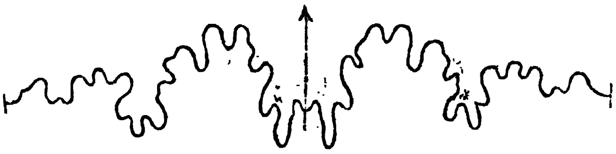
Fig. 18.



Clymenia striata. (Munster.)

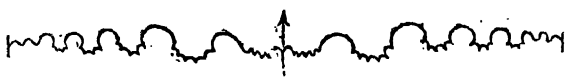
Compared with ordinary ammonites, the differences of the sutures are easily seized; but by the group of Ceratites of Haan, which is supposed to be peculiar to the muschelkalk, the transition is not difficult, as the subjoined figures show

Fig. 19.



Ammonites planicostatus. (Sowerby.)

Fig. 20.



Ceratites nodosus *var.*

Professor Phillips has mentioned in the carboniferous limestone of the north of England some otherwise genuine nautili with dorsal siphon—their sutures cannot be made to agree with the Goniatites; and others with a ventral siphon, which yet cannot be ranked with Clymenia. (*Geol. of Yorkshire*, vol. ii.)

Distribution of the Species.—Goniatites, and their allies, the Clymeniæ, appear entirely confined to the rocks of the carboniferous and older systems of strata. Only one species (Goniates Listeri, Sowerby) is mentioned as occurring in the coal-formation, and that in the lowest portion (near Bradford, Halifax, and Sheffield, Yorkshire). In the shales and limestones of the millstone grit and mountain limestone series of England and Ireland, Professor Phillips describes and figures 33 species; Beyrich gives (from Goldfuss), 2 others; Von Buch (Gon. expansus), 1 other: total in carboniferous system, 36 species.

In the strata presumed to lie below the old red sand stone occur many other species; at least so is the fact on the continent of Europe, though in Great Britain and Ireland they are but rarely met with in the primary and transition strata.

Twenty-six were described by Munster from the Fichtelgebirge alone; and Beyrich admits in his general summary (1837) as many as thirty-six species from the transition strata.

The Goniatites yet described are almost entirely from European localities. Von Dechen quotes G. Listeri from India. (*Handbuch der Geognosie.*) We have seen no specimens from North America. None are mentioned in the slaty rocks of Westmoreland or Wales; none occurred to Mr. Murchison along the range of the Silurian rocks: they are not rare in Devonshire (occurring about Barnstaple and near Launceston). It is in the North of England, from Derbyshire to the Tweed, and in the limestones of the carboniferous system of strata, that they specially abound. About Enniskillen, and near Castleton, in the Isle of Man, the same rocks yield a considerable number of species.

GONIO'METER (from two Greek words, γωνία, an angle, μέτρον, a measure) is the name of an instrument employed to determine the angles at which the planes of crystals are inclined to each other. [ANGLE; PLANE.] The principle of the common goniometer is simply this. It may easily be shown that if two right lines intersect one another, the opposite angles thus formed will be equal. Hence, regarding the point of intersection as a centre, about which either of those right lines is free to revolve while the other remains fixed, if we suppose one of the edges of a solid bounded by plane surfaces to be applied to that centre, so that the edge may be perpendicular to the plane in which the two right lines are situated, and then suppose the lines to coincide with the two contiguous planes of the solid, it will be evident that the divergence of the lines will be the measure of the inclination of the planes. A graduated arc being now adjusted to the line which we supposed fixed, the position of the other line would indicate the number of degrees at which the planes of the solid were inclined to each other. As this instrument however, when applied to laminated substances, such as crystals, is incapable of affording results sufficiently accurate to determine the species to which the crystal belongs, in consequence of the frequent irregularity of the fracture and the ordinary minuteness of the planes, we shall, without dwelling longer upon its construction, proceed to describe the more perfect instrument invented by Dr. Wollaston, and called the reflective goniometer.

It is well known that a ray of light falling upon a polished plane is reflected at an angle equal to the angle of incidence, and that to an eye situated in the direction of the reflected ray the object from which the ray emanated will appear as much below that plane as it is really above it. If therefore we place one of the planes of a crystal in such a position that the reflection of an object above the plane may appear to coincide with another object beneath, and then turn the crystal until the reflection of the same object above (from the second plane of the crystal) shall again appear to coincide with the same object below, it will readily appear that the arc which the crystal will have described will be the measure of the supplement of the inclination of its two planes, that is, the difference between that inclination and 180°. In turning the crystal the direction of the edge common to its two planes should not be altered, and the rays in both instances should be reflected from that portion of the planes nearest to their common edge, otherwise the observation will be affected by parallax. Such is the principle of Dr. Wollaston's reflective goniometer, by means of which the inclination of planes whose area is less than the 100,000th part of a square inch may be determined within a minute of a degree, and which is equally effective whether the fracture be even or irregular. The instrument itself consists of a graduated circle mounted upon a horizontal axis, to one extremity of which is attached a moveable pin, having a slit for the purpose of receiving a small brass plate. To this plate the crystal is attached by means of a piece of wax, so that it may project beyond the edge of the plate. The pin (which is provided with a vertical and horizontal movement) is then raised or lowered until the reflection of any convenient object above appears to coincide with some other object beneath. The instrument being thus adjusted, the graduated circle is turned until a similar reflection is obtained from the contiguous side of the crystal. The arc which the circle will then have described will (as was before stated) be equal to the supplement of the inclination of the crystalline planes; but the margin of the circle being graduated in an inverted order, the true inclination is given without further computation, and may be read off by means of the vernier [VERNIER] with considerable accuracy.

GONIOMETRY, the measurement of angles; a name which should be substituted for TRIGONOMETRY, if it were advisable to alter established designations. The latter science, beginning with the measurement of triangles, made all that was known of the analysis of angular magnitude its own peculiar instrument. The various accessions which real goniometry received were therefore considered as additions to trigonometry: so that at this day, under a word which imports measurement of triangles, we have a science which wanders as far from the etymology of its name as geometry does.

GONIO'PORA. [MADREPHYLLIÆA.]

GO'NOPLAX, GONOPLAX TRIBE, GONOPLACIANS, Brachyurous crustaceans (belonging to the family of *Catametopes*) whose *carapace* is either square or rhomboidal, and much wider than it is long. The posterior border, measured between the base of the fifth pair of feet, equals, nearly always, the half of its transverse diameter; while in the tribe of *Ocypodians*, as well as in the *Cyclometopes*, and the greater part of the *Oxyrhynchi*, the length of this border is only about a fourth of the greatest width of the carapace. The *front* is but little inclined, and very wide; it does not curve downwards so as to unite itself throughout nearly its whole width to the *epistome*, as in the *Ocypodians*, and it is equal to two-thirds of the buccal frame measured at the point of its greatest width. The *ocular peduncles* are in general very much elongated and rather small; their length often equals five or six times that of their diameter, and the *cornea* which terminates them is always small. The external angle of the *orbit* ordinarily occupies the lateral extremity of the carapace. The *internal antennæ* are always horizontal, quite exposed, and lodged in little pits (fossettes) distinct from the orbits. The *external antennæ* are disposed nearly as in the *Ocypodians*. The *epistome* is often placed at some distance behind the inferior orbitary border, a character which is always met with in the *Cyclometopes*, and exists but rarely in the family of *Catametopes*. The *buccal frame* is generally wider at its anterior border than at its posterior part, and the fourth joint of the *external jaw-feet* is inserted nearly always at the internal angle of the preceding articulation. The *sternal plastron* is very wide, and is sometimes perforated for the passage of the intromissive male organs (les verges); but in general these organs are inserted, as in other families, at the basilary joint of the posterior feet, and are lodged in a small transversal canal hollowed in the sternal plastron at the point of union of its two last segments, a canal which serves them for a sheath till they arrive under the abdomen. The length of the anterior feet varies; it is sometimes very considerable, and those of the third or fourth pair, which are always the longest among the eight last, have nearly two and a half times the length of the post-frontal portion of the carapace: they are all slender, and terminated by a styliform tarsus. The *abdomen* of the *female* is very wide, and covers nearly the whole of the sternal plastron; but that of the *male*, on the contrary, is very narrow, and instead of extending to the basilary joint of the posterior feet, leaves exposed a considerable portion of the sternal plastron between its external edge and the base of those feet. In the greater number of cases its second ring is entirely linear, while the others are sufficiently well developed.

Such is the character given to this tribe by M. Milne Edwards, who places it between the *Ocypodians* and the *Grapsöidians*, and divides it into the four following genera.

Pseudorhombila. (Milne Edwards.)

M. Milne Edwards states that the crustacean which is the type of this new genus is very remarkable, inasmuch as it holds a middle place between the *Cancerians* and the *Gonoplaxes*. The form of its *carapace* approaches that of the *Panopes*, and of some other *Cancerians*, for it is slightly arched in front, and between the orbits and the lateral borders a considerable portion of its contour is curved backwards after the manner of the latero-anterior border of the carapace of the *Cyclometopes*; but nevertheless its general form is that of a rhomb, and its posterior border occupies more than the third of its diameter. The body is very thick, and much elevated anteriorly. *Front* nearly horizontal and divided into two truncated, very large lobes. *Eyes, antennæ, epistome*, and *external jaw-feet*, presenting the same disposition as in the crabs. *Sternal plastron* much wider than long, and very strongly curved from before backwards; at its posterior part, which is very wide, may be remarked on each side, in the male, a canal of considerable calibre, which lodges the intromissive organs, the origin of which may be seen at the base of the posterior feet. The *anterior feet* are very strong, and very long in the male; the succeeding feet present nothing remarkable, except that those of the second pair are nearly of the same length as those of the third pair, and that these last are rather shorter than the following ones. The form of the abdominal appendages differs but little from the form of those of *Xanthus*.

Example, *Pseudorhombila quadridentata*. Length about 2 inches; colour rosy. *Locality* unknown.

M. Milne Edwards adds that the crustaceans figured by De Haan under the name of *Cancer (Curtonotus) longimanus* (*Fauna Japonica*, Crust., pl. vi., fig. 1) appear to him to come very near the preceding species; but as the description was not published, he could not pronounce upon their identity.

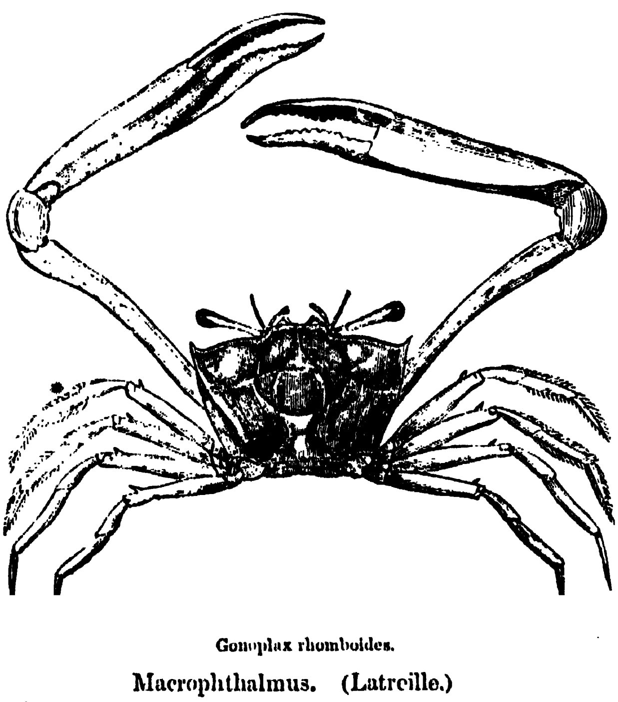
Gonoplax. (Leach.)

Carapace more than one and a half times as wide as it is long, and rather strongly narrowed backwards; the fronto-orbitary border extends the whole of its width, and the front itself is lamellar, slightly inclined and terminated by a straight border. The *ocular peduncles* equal more than a third of the width of the carapace; they are of medium size, and present no notable swelling at their extremity. The *internal antennæ* are large and of ordinary form; the basilary joint of the external antennæ is small and cylindrical like the following ones, and their terminal stem is very long. The *epistome* is much less advanced than the lower border of the orbit; the *buccal frame* is much wider than it is long, and a little narrowed backwards: the form of the *external jaw-feet* is the same as in the crabs. The disposition of the *sternal plastron* is nearly the same as in *Pseudorhombila*, but it is to be remarked that the transversal canal which lodges each of the intromissive organs is not completely shut below. The *anterior feet* are extremely long and nearly cylindrical; those of the second pair are longer than the second or the third; and those of the last pair are nearly of the same length as the second. The *abdomen* of the *male* presents seven distinct joints, like that of the *female*.

Example, *Gonoplax rhomboïdes*. M. Milne Edwards remarks, that M. Latreille believed that this species could not be distinguished from *Gonoplax angulata*, and says that perhaps it may be only a variety; but he at the same time retains it as a species, and points out certain differences between it and *G. angulata*. Length about an inch; colour yellowish mingled with red.

Locality.—The Mediterranean and the Ocean; keeps among rocks at considerable depths, and seems to live solitary: according to M. Risso it swims with facility, and rises often to the surface of the water without ever coming out.

Food.—Small fish and radiated animals.



Gonoplax rhomboides.

Macrophthalmus. (Latreille.)

A genus with the general contour of *Gonoplax*, but distinguished by the form of the jaw-feet, and, above all, by the length of the ocular peduncles. *Carapace* rhomboïdal and very wide; the transverse diameter is sometimes twice as long as the longitudinal diameter, and the anterior border occupies the whole length of it; stomachal region small and nearly quadrilateral; branchial regions large and nearly of the same form. *Front* curved downwards, very narrow, and resembling that of *Ocypode*; it only occupies about the fifth of the transversal diameter of the carapace, and does not entirely cover the basilary portion of the *ocular peduncles*, which are very long, slender, and terminated by a somewhat oval and very small cornea. The *orbits* have the form of a transversal groove hollowed out under the anterior border of the carapace, and directed obliquely up; within, their inferior border is much more projecting than their superior border, but below the external angle it is incomplete, so that their cavity is not closed at this point. The *internal antennæ* are lodged under the front, and their stem of a fair length is bent transversely; the disposition of the *external antennæ* is nearly the same as in *Gonoplax*. The *epistome* is linear, and is continued with the lower orbitary border. The *buccal frame* is wider than it is long, and arched (cintré) in front. The *external jaw-feet* do not meet ('ne se rencontrent pas tout-à-fait'); their second joint is very wide, and the third much less, especially anteriorly, supports at the external angle of its anterior border the terminal stemlet ('tigelle terminale'). The *sternal plastron* is nearly of the same form as in *Gonoplax*, but much wider; and, in the male, instead of presenting transversal grooves for the lodgement of the intromissive organs, which in the genus last-named come out at the base of the posterior feet, it is itself perforated at a distance from the border to give a direct passage to these appendages of the spermatic conduits. The disposition of the feet is nearly the same as in *Gonoplax*.

Example, *Macrophthalmus transversus*. Length about ten lines. Some hairs on the feet.

Locality.—Pondichéry. (Milne Edwards.)

Cleistotoma. (De Haan.)

Front much wider than in *Macrophthalmus*, occupying about the third of the anterior border of the *carapace*, and a little inclined; *ocular peduncles* large, and of moderate length; orbits of the ordinary form; *buccal frame* at least as wide in front as behind; third joint of the *external jaw-feet* nearly of the same size as the second, and nearly square; *anterior feet* short in the two sexes.

Example, *Cleistotoma Leachii*. *Carapace* smooth and hairless; *hands* (manus) very large in the male; thighs granulous above. Length four lines.

Locality.—Red Sea.

M. Milne Edwards thinks that *Ocypode (Cleistotoma) dilatata* (De Haan, *Fauna Japonica*, Crust., pl. vii., fig. 3), the figure only of which is published, comes very near to *C. Leachii*; and he is also of opinion that the crustacean figured by M. Savigny, Pl. ii., No. 2, and designated by M. Audouin as *Macrophthalmus Boscii*, might be referred to this genus. M. Milne Edwards however had not examined the buccal apparatus.

Fossil Gonoplacians.

M. Desmarest (*Hist. Nat. des Crustacés Fossiles*) enumerates the following fossil species of the genus *Gonoplax*, Leach. *Gonoplax Latreillii*, generally incrusted in an argillaceous, greyish, rather hard limestone, which does not soften in water (calcaire argileux grisâtre assez dur, et qui ne se délaie pas dans l'eau); from the East Indies. *Gonoplax incisa* (Cancer lapidescens of Rumphius), incrusted in a grey calcareous, argillaceous and sandy stone; from the Indies, rather frequent. *Gonoplax emarginata* in an argillaceous, sandy calcareous stone of a yellowish-grey; frequent in collections, and noted as coming from the East Indies. *Gonoplax impressa*, approaching very near to the other species from the East Indies in its colour and in the incrusting stone, whence M. Desmarest is much inclined to think that it came from the same stratum. At the same time he says, that it should be stated that the specimen came to him from the Muséum d'Histoire Naturelle, in a wrapper marked 'From Mount Marius, at Rome.' *Gonoplax incerta*: locality not mentioned; the specimen belonged to the Marquis de Drée.

M. Milne Edwards observes, that the last-mentioned species, which is referred by M. Desmarest to the genus *Gonoplax*, approaches the recent species in form, and may well belong to the group; but its carapace is square instead of trapezoïdal, and the lateral borders are not arched. M. Milne Edwards is further of opinion that the greater part of the fossil *Gonoplacians* described by M. Desmarest ought to be referred to the genus *Macrophthalmus* rather than to *Gonoplax*, for the form of their front, and even that of the ca-

rapace in general, is entirely that of the *Macrophthalmi*, and differs remarkably from the shape of the same parts in *Gonoplax*; and he records the following species:—*Macrophthalmus Latreillii* (*Gonoplax Latreillii*, Desm.); *Macrophthalmus incisus* (*Cancer lapidescens*, Rumph.; *Gonoplax incisa*, Desm.); *Macrophthalmus emarginatus* (*Gonoplax emarginata*, Desm.). Of *Gonoplax impressa* M. Milne Edwards remarks that it comes very near the preceding species, but ought not to be referred to the same genus, because its carapace is nearly as long as it is wide, and its anterior feet are very short and convex (renflées).

GONZA'GA, a historical family of Italy, which was numbered among the sovereigns of that country as hereditary dukes of Mantua and Monferrato for more than three centuries. The Gonzaga, like the Medici, did not belong to the feudal nobility; they were originally a plebeian family, which took its name from their native village. Luigi Gonzaga was appointed Podestà of Modena in 1313, through the influence of Passerino Bonacolsi, lord of Mantua. In 1328, a conspiracy having broken out at Mantua against Bonacolsi, who was murdered with all his relatives, Luigi Gonzaga, who was privy to the conspiracy under the pretence of restoring liberty to his country, was appointed captain-general, and in the following year the Emperor Louis of Bavaria made him imperial vicar of Mantua. From that time the Gonzagas became hereditary rulers of that country. A century later they assumed the title of marquises of Mantua, still acknowledging themselves feudatories of the Empire. They were repeatedly engaged in war with the Visconti of Milan. In 1495 Gianfrancesco Gonzaga placed himself at the head of the Italian league, for the purpose of driving the French under Charles VIII. out of Italy. He commanded at the battle of Tornovo on the river Taro, on the 6th July of that year, in which the French were worsted, and Charles was obliged to make a precipitate retreat across the Alps. Gonzaga then marched towards Naples, was present at the battle of Atella, and contributed with Gonzalo of Cordova to the evacuation of the kingdom by the French, and the restoration of the Aragonese dynasty. When Louis XII. again invaded Lombardy, Gonzaga was obliged, in order to save himself, to do homage to him, and in 1509 he joined the league of Cambrai against the Venetians. His son Frederic fought against the French commanded by Lautrec and Bonnivet; and as a reward for his services was made duke of Mantua by Charles V., and obtained also the marquisate of Monferrato in 1536. Frederic's brother, Ferrante Gonzaga, distinguished himself also in the imperial service, and was made by Charles V. governor of the Milanese. He founded the line of the dukes of Guastalla, a principality which he obtained partly by purchase and partly by intrigue. Guglielmo, son and successor of Frederic, was humpbacked, and it is recorded that when he ascended the ducal throne the courtiers vied with each other in putting on artificial humps, thinking to please their sovereign thereby. He proved a good prince, and he protected the learned; Bernardo Tasso, the father of Torquato, was his secretary; Paolo Sarpi was for a time his theologian, and the Jesuit Possevin his confessor. The city of Mantua in his time had a population of 43,000 inhabitants, almost double its present number. His son Vincenzo early showed a disposition for learning, and a fondness for learned men. He went to Ferrara on purpose to effect the deliverance of Torquato Tasso, who was confined as being insane, and he obtained his liberty from the Duke Alfonso d'Este. But in the course of time, after he succeeded his father on the ducal throne, Vincenzo abandoned himself entirely to pleasure, neglected the interests of his subjects, and dilapidated the property of his own family. It was he who has been charged with the assassination of James Crichton, in 1583, who had been his preceptor. [CRICHTON.] Vincenzo died in 1612, and was succeeded by his son Francis, who began by introducing economy into the palace, from which he drove away the actors, singers, and parasites whom his father had gathered round him. He died a few months after his accession, and was succeeded by his brother, Cardinal Ferdinando Gonzaga, who, dying in 1626, left his states to his other brother, Vincenzo, who died in the following year. None of these three princes left any legitimate son, and with the last, Vincenzo, the direct line of the house of Gonzaga became extinct in 1627. It was however succeeded in the sovereignty by the lateral branch of Nevers, descended from Louis, brother of Guglielmo the humpbacked, who, having gone to France, had married there Henrietta of Cleves, heiress of the duchies of Nevers and Rethel. His son Charles was called to Italy by the prospect of the extinction of the ducal house of Mantua, and after the death of his cousin, the Duke Vincenzo, he claimed the succession to the ducal throne. But his claims were disputed by his cousin Gonzaga, duke of Guastalla, a descendant of Don Ferrante, already mentioned; and the duke of Savoy, seizing the pretext of the disputed succession, invaded Monferrato, upon which he had some old claims, while the Emperor Ferdinand II. on his side invaded Mantua as an imperial fief. Louis XIII. took the part of the duke of Nevers, and the question of the Mantua succession occasioned a European war. The French entered Piedmont, and obliged the duke of Savoy to raise the siege of Casale in Monferrato in 1629, while the imperial army took Mantua after an obstinate siege, and pillaged the town for three days. The paintings, statues, and other works of art, collected during centuries by the dukes Gonzaga, were carried to Prague, many of them were purchased by Christina of Sweden, and afterwards bought by the duke of Orleans for his gallery of the Palais Royal. At last, in 1630, by the treaty of Ratisbon, between the emperor and France, and that of Cherasco, with the duke of Savoy, Charles of Nevers was put in possession of Mantua and Monferrato, and received the solemn investiture from the emperor. In 1635 he seized upon the principality of Correggio, which he added to his dominions. He died in 1637, and was succeeded by his grandson Charles, under the regency of his mother. Charles proved a weak dissipated prince; he wavered between the French and Spanish alliances during the Italian wars; he sold, in 1659, the duchies of Nevers and Rethel and his other possessions in France to Cardinal Mazarin, and died in 1665, leaving an only son, Ferdinand Charles, under the guardianship of his mother, who was an Austrian archduchess. Ferdinand, once on the throne, showed himself even more dissolute than his father. He collected at his court female performers, singers, and dancers from every part of Italy, in whose company he delighted, and by whom he was attended when he travelled about. On the breaking out of the war of the Spanish succession, Ferdinand, although a feudatory of the emperor, allowed the French to garrison Mantua. The Emperor Joseph I. put him under the ban of the empire as a traitor; and as the French ultimately lost their footing in Italy, the Austrians took possession of Mantua, which was annexed to the Milanese. Ferdinand being deserted by the French, for whose sake he had lost his dominions, retired to Padua, where he died in 1708, leaving no issue. He was the last duke of Mantua. The other lateral branches of the Gonzagas, of Guastalla, Sabbioneta, Novellara, and Castiglione, became also extinct, or were dispossessed of their principalities. Some of their descendants were living at Mantua not many years since as private individuals. The eighteenth century saw the extinction of three Italian sovereign houses, Medici, Gonzaga, and Farnese, while that of Este has been perpetuated only by a female. (Litta, *Famiglie celebri Italiane*; Botta, *Storia d'Italia*, b. 34; Goselini, *Vita di Don Ferrante Gonzaga*, 1574.)

GONZA'LO, HERNANDEZ DE CO'RDOVA, surnamed the Great Captain, was born of noble and wealthy parents at Montilla, near that city, in 1453. Having early lost his father, he was brought up by a knight called Diego Cárcamo, who inspired him with that grandeur of soul and love of glory by which Gonzalo amply compensated the disadvantages to which the law of primogeniture had subjected him as a second son. When the city of Cordova espoused the cause of the Infante Don Alonso against his brother Henry IV., Gonzalo, though yet an inexperienced youth, was sent by his own brother Alonso de Aguilar to Avila, where the unfortunate Henry was solemnly despoiled of crown and sceptre. On the sudden death of the new king, his sister Isabella, the right heiress to the Castilian crown, also requested the service of Gonzalo against the partisans of Juana, called La Bertraneja, the dubious daughter of the dethroned Henry, who was married to the king of Portugal.

Gonzalo, by his military and fashionable accomplishments, heightened by his character for generosity, was hailed as the prince of the Spanish youth, and became the greatest

ornament of Isabella's court. His intrepidity at the head of 120 horse belonging to his brother which aided in the defeat of the Portuguese at Albuera, excited general admiration. In the protracted contest of ten years, which resulted in the final conquest of Granada, he took part in all the important engagements, and also carried on a sort of constant guerrilla warfare, which struck the Moors with terror and amazement.

When Charles VIII. of France, instigated by Ludovico Sforza of Milan, conquered Naples in 1495, Gonzalo was sent by Ferdinand the Catholic to expel the invaders, and restore the crown to the native king. Europe was soon astonished by the brilliancy and rapidity of his success. His only difficulty was to garrison the numerous places which he reduced in quick succession. Both friends and foes proclaimed him the Great Captain, a title which has always been attached to his person and memory.

After the expulsion of the French from Naples, Pope Alexander VI. called in the aid of Gonzalo against one Menoldo Guerri of Biscay, to whom Charles VIII., on his retreat, delivered Ostia in trust, and who, by his exactions from the trading-vessels of the Tiber, distressed and starved Rome. Gonzalo surrounded that fortress with his veterans, stormed it on the eighth day, and the capital of Christendom beheld the hero of the age bringing in chains the monster who had kept her so long in alarm—a modern triumph, the glory of which the conqueror enhanced by requesting and obtaining the pardon of the vanquished, and an exemption from all taxes, during ten years, for the inhabitants of Ostia and its environs. He took leave of the pontiff by pointing out the necessity of a reform in his household and court. Thus did the Great Captain crown his first expedition to Italy in 1498. Two years after he suppressed a revolt of the converted Moors in the Alpujarras, and requested their pardon also as the reward of his victory.

Louis XII., inheriting the throne and the ambition of his cousin Charles VIII., made preparations to expel Sforza from Milan, and to stretch his arm as far as Naples. Ferdinand, who now agreed to partake of the spoils, sent Gonzalo to Italy again, but only as an ally of the Venetians. The first result of this campaign was the taking of Cephalonia from the Turks, after a glorious siege of fifty days, at the end of 1500. On the first news of the deposition of the king of Naples being sanctioned by the pope, Gonzalo gave up the estates with which that king had rewarded his previous services. Subsequently however he stained his character by an act of which he repented in his old age; he sent the hereditary prince, the duke of Calabria, as a prisoner to Spain, notwithstanding he had solemnly bound himself to respect his liberty, under the plea of Ferdinand's disapproval of that pledge, which wanted his previous royal consent. The partition of Naples between the Spanish and French soon brought them into collision, and afforded Gonzalo a second and more brilliant opportunity of defeating and finally driving away the French, and of reconciling the natives to the Spanish sway. Ferdinand at last grew jealous of a subject whose brilliant success threw the kingly dignity into the shade. Even in the decline of his authority and power, after Isabella's death, and when Gonzalo, in a letter dated Naples, 2nd July, 1506, reassured him of his unconditional and most firm adherence, and when the pope and the Venetians strove to place the Great Captain at the head of their respective forces, even then the distrustful king did not cease to make common cause with the envious courtiers, and persisted and succeeded in removing his most faithful subject from Italy.

Returning to his country in 1507, and passing through Savona, where Ferdinand and Louis XII. had an interview, he received the highest attentions from the French king and his suite. More flattering still and bordering almost on adoration was his reception in every part of Spain, except at court, where he met only with contumely. He was even refused the mastership of Santiago, which had been so often and so solemnly promised him; nor could he obtain leave to join Cardinal Cisneros in his expedition to Africa. Nevertheless, in the hour of need, when the new viceroy of Naples, Don Ramon de Cardona, was defeated at Ravenna by Gaston de Foix, on Easter-day, April 11th, 1512, Ferdinand, panic-struck, turned his eyes to the Great Captain for succour, and requested him to organize a fresh expedition to Italy. But just when he was ready to depart with his veterans and the volunteers who had flocked to his standard, Ferdinand's fears subsided, and distrust reassuming its wonted sway over his mind, he ordered the disbanding of the forces. As the army was composed of numerous volunteers who had parted with all their property, in order to furnish themselves for the expedition, their intended leader grieved at the sacrifices which they had made, and keenly feeling their disappointment, convened them at Antequera, and rewarded them in a princely style. Such was the best way of enjoying his wealth, he said, when remonstrated with for the extravagance of his munificence. At the same time he wrote to the king a letter replete with bitterness and complaint. At length an accumulation of mental suffering impaired his health, and terminated his existence on the 2nd of December, 1515. Two hundred tattered banners and two royal pennons, once unfurled by the enemy, waved over the tomb of this hero of the fifteenth century, who raised the Spanish soldiery to that superiority which they maintained in Europe for nearly two hundred years. (Quintana, *Españoles Celebres*, or Preston's English translation.)

GOOD FRIDAY, the name given to the day of our Saviour's Crucifixion. From the earliest ages of Christianity this day, emphatically called Good Friday, has been held as a solemn fast; its appellation of *Good* being applied to express the blessed effects which sprang from that important event.

It is in England only that this day has the appellation of Good: its antient and appropriate title was Holy Friday, the Friday in Holy Week.

Offices called *Tenebræ*, that is, 'darkness,' are sung on this day, and on its eve and morrow, by those belonging to the Romish faith. The lights are extinguished in reference to the supernatural darkness at our Saviour's Crucifixion, and nearly at the end of the service a solemn silence is observed throughout the church, which is suddenly succeeded by a tremendous noise, in token of the rending of the veil of the Temple, and of the disorder in which the very frame of nature was involved at that momentous event.

Cakes made for the day, called, from the mark impressed upon them, cross-buns, still, even in the metropolis, form the general breakfast on Good Friday; but are not further noticed. In some of the distant counties, such as are not eaten are preserved, to be used as an infallible cure for the faithful throughout the year. The practice of making cross-buns is supposed to have originated simply in the desire of marking on the only food antiently allowed on this solemn fast a symbol of the Crucifixion.

Hospinian (*De Orig. Festorum*, fol. 61 b.) tells us that the kings of England had a custom of hallowing rings with much ceremony on Good Friday, the wearers of which would not be afflicted with the falling-sickness. He adds that the custom took its rise from a ring which had long been preserved in Westminster Abbey, and was supposed to have great efficacy against the cramp and falling-sickness, when touched by those who were afflicted with either of those disorders. It was reported to have been brought to King Edward (probably Edward the Confessor) by some persons coming from Jerusalem. Lord Berners, the accomplished translator of Froissart, when ambassador to Charles V., writing to Cardinal Wolsey from Saragoça, June 21, 1518, says, 'If your grace remember me with some *Cramp-Rings*, ye shall do a thing much looked for; and I trust to bestow them well with God's grace, who evermore preserve and increase your most reverend estate.' (*Harl. MS.* 295, fol. 119 b.)

Creeping to the Cross on Good Friday was another of the Popish ceremonies formerly practised in England. The ceremonial of it is given by Bishop Percy in the notes to the 'Northumberland Household Book.'

(Brady's *Clavis Calendaria*, vol. i., p. 265-269; Brand's *Popular Antiq.*, 4to., vol. i., p. 128-133.)

GOOD HOPE, CAPE OF. [CAPE OF GOOD HOPE.]

GOOD, JOHN MASON, M.D., was born on the 25th of May, 1764, at Epping, where his father was minister of an Independent congregation. He was educated at home, where he studied Latin, Greek, and French. At fifteen years old he was apprenticed to a surgeon in Gosport, on leaving whom he studied for a short time at Guy's Hospital, and, in 1784, commenced practice in partnership with a surgeon at Sudbury. He met however with but slight success; and in consequence of having engaged himself as security for a friend who failed, he was induced to remove to London in 1793, principally with a view of obtaining em-

ployment in literature. For a time his progress was very slow; but by perseverance he succeeded, and in 1820 found himself so well established, both in literary and professional fame, that he determined on taking the diploma of M.D. at Marischal College, Aberdeen. From this time to his death, which occurred in January, 1827, after a long and painful illness, he continued actively pursuing the practice of medicine and the study of almost all branches of science and literature.

Dr. Good was a voluminous and learned writer on various subjects; his principal works were the following:—

1795. 'Dissertation on Diseases of Prisons and Poorhouses,' prize essay, published at the request of the London Medical Society, 12mo. 1795. 'A Short History of Medicine,' published at the request of the Pharmaceutical Society, 12mo. It consists principally of an accurate history of the practice of apothecaries in England. 1800. 'Translation, in verse, of the Song of Solomon.' 1803. 'Memoirs of Dr. Geddes,' 1 vol. 8vo. 1805. 'Translation of Lucretius' (in verse), 2 vols. 4to., his principal classical work. 1812. 'Translation of the Book of Job,' 1 vol. 8vo. 1820. 'Physiological System of Nosology, with a corrected and simplified nomenclature,' 1 vol. 8vo. He had been twelve years collecting materials for this work, and it served as an introduction to the larger one which he published in 1822. 1821. 'Translation of the Book of Proverbs.' 1822. 'Study of Medicine,' in 4 vols. 8vo., consisting of a digest of the several systems of nosology previously published, and an attempt to classify all described diseases in regular orders, genera, &c., as in the arrangements employed in natural history. 1826. 'Book of Nature,' 3 vols. 8vo. This work contained the lectures delivered by the author at the Surrey Institution on the phænomena, 1st, of the material world; 2nd, of the animate world; 3rd, of the mind.

'A Translation of the Book of Psalms' was just completed at the time of his death. These however were but a portion of his works; for some time previous to settling in London he had been a large contributor to the World, a daily newspaper, at that time in extensive circulation, and to the 'Analytical and Critical Review.' Of the latter he was for a considerable time the editor; and a great number of the most celebrated articles on theology, morals, and Eastern literature in it, as well as in the British and Monthly Magazines, were from his pen. He was engaged at the same time in many other literary pursuits, as in the editing of the 'Pantologia,' in conjunction with Mr. Bosworth and Dr. O. Gregory.

The extent and variety of Dr. Good's works are sufficient to indicate their character; they evince the greatest industry, with a retentive and orderly mind, and every mark of sincerity and piety; but they show that he was deficient in personal observation, and his medical writings especially are hence of far less value than the labour that must have been bestowed upon them might have given them, had it been better directed. His principal faculty seems to have been a facility of acquiring languages: he had learned Latin, Greek, and French, in his father's school; while an apprentice he acquired Italian, and soon after commenced Hebrew. While engaged in the translation of Lucretius he studied German, Spanish, and Portuguese; and afterwards, at different times, Arabic, Persian, Russian, Sanscrit, and Chinese. Of his knowledge of all these, sufficient evidence is presented in unpublished translations, in reviews of their literature, and in the constant references made to their works in his medical and other writings. A biography of Dr. Good has been published by his friend Dr. Olinthus Gregory, in 1 vol. 8vo.

GOODENIACEÆ, a small natural order of Exogens, chiefly inhabiting New Holland, and in that country representing the Campanulaceæ and Lobeliaceæ of the northern hemisphere. They are in fact so nearly allied to the latter, that they can scarcely be said to differ in anything of importance, except the presence of a cupule surrounding the stigma. This cupule is a fleshy or membranous cup, sometimes undivided, sometimes lacerated, within the base of which the stigma is situated. It appears to be formed by the consolidation of the hairs which in Campanulaceæ so thickly clothe the style, and which in some Lobelias are collected into a ring. Where the cupule is lacerated at the edge, it is to be supposed that the consolidation of the hairs has only taken place imperfectly. Nine or ten genera are all that this order contains. The prevailing colour of their flowers is yellow; and some of them are sufficiently handsome to be worth cultivation. They are all herbaceous plants, of no known use.

Goodenia Ovata. 1. A front view of a corolla. 2. The ovary with the stamens, style, and cupule surrounding the stigma. 3. The ovary with the superior calyx.

GOODWIN SANDS. [Kent.]

GOOMTEZ. [Hindustan.]

GOORIA. [Georgia.]

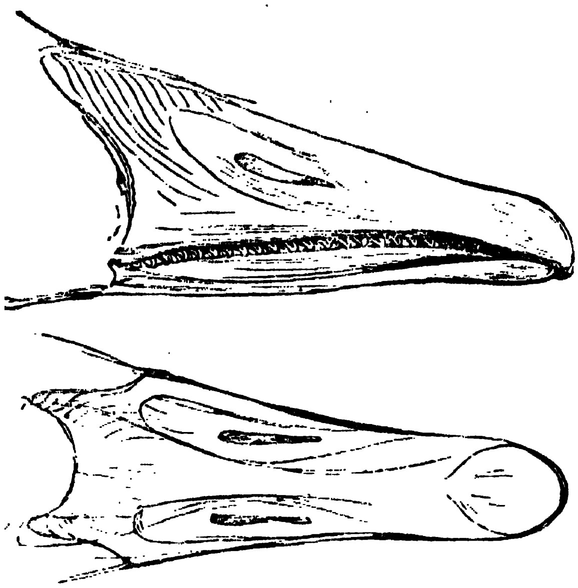
GOOSANDER. [Merganinæ.]

GOOSE, GOOSE-TRIBE, ANSERINÆ, a subfamily of *Anatidæ*.

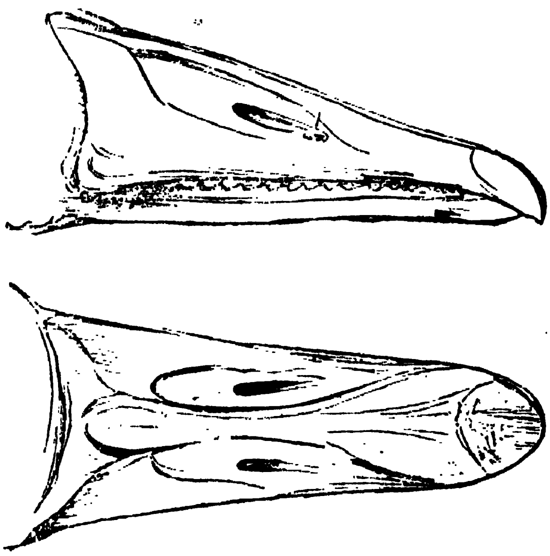
The reader will find under the articles Anatidæ, Anser, Birds, Ducks, and Fuligulinæ, the views of ornithologists generally as to the position occupied by the subfamily of Geese. Mr. Swainson, in the 'Classification of Birds,' (vol. ii., 8vo., Lond. 1837), considers that the *Anserinæ* constitute the rasorial subfamily of the whole group of *Anatidæ*. Although much nearer related, in Mr. Swainson's opinion, to the true ducks than are the Flamingos (*Phœnicoptinæ*, Sw.), next to which he places them, they are, he remarks, nevertheless much more terrestrial in their habits; and in their strong and high legs, fondness for grain and vegetables, and comparative shortness of wing, he traces many of the chief characters of the rasorial type. The first form, after quitting the Flamingos, seems to him to be the natatorial genus *Cygnus*, which, by its great length of neck and large-sized body, softens down the interval between the Ducks and the *Phœnicoptinæ*. 'We next,' continues Mr. Swainson, 'come to the true geese, forming the genus *Anser*, the typical division of the whole group, and which contains most, if not all, of the usual subgenera. The tree geese (or ducks, as they have been called) next follow, among which the subgenus *Chenaloplex* (Chenalopex?) will probably find a place. *Plectropterus* is the rasorial genus analogous, by its spur-wings, to the *Rallidæ*, while the Australian genus *Cereopsis* (equally representing the pigeons) appears alone necessary to complete this circle.' In his 'Synopsis' (part iv. of the same vol.) Mr. Swainson makes the *Anatidæ* consist of the following subfamilies:—*Phœnicoptinæ*, *Anserinæ*, *Anatinæ*, *Fuligulinæ*, and *Merganidæ* (Merganinæ?). The subgenera of the *Anserinæ*, he says, have not yet been determined, but he gives the following genera: —*Cygnus*, Antiq., *Swans*; *Anser*, Antiq., *Geese* (A. hyperboreus, Bernicla); *Dendrocygna*, Sw., *Tree Ducks* (D. arcuata, Horsf., Java; arborea, Edw.); *Plectropterus*, Leach, *P. Gambenses* (Gambensis?); and *Cereopsis*, Lath., *Pigeon Goose*.

Mr. Eyton, in his arrangement of the *Anatidæ* [Fuligulinæ, vol. xi., p. 12], makes the subfamily *Plectropterinæ* consist of the genera *Choristopus*, Eyton (*Anas semipalmatus*, Lath.), and the genus *Plectropterus* of authors. The subfamily *Anserinæ*, according to the same ornithologist, embraces the genera *Cereopsis*, Lath.; *Chloephaga*, Eyton (*Anser Magellanicus* of authors); *Bernicla*, Briss.; *Anser* of authors; *Cygnus* of authors; *Sarkidiornis* (*Carina regia*, Steph.); and *Chenalopex* of the antients.

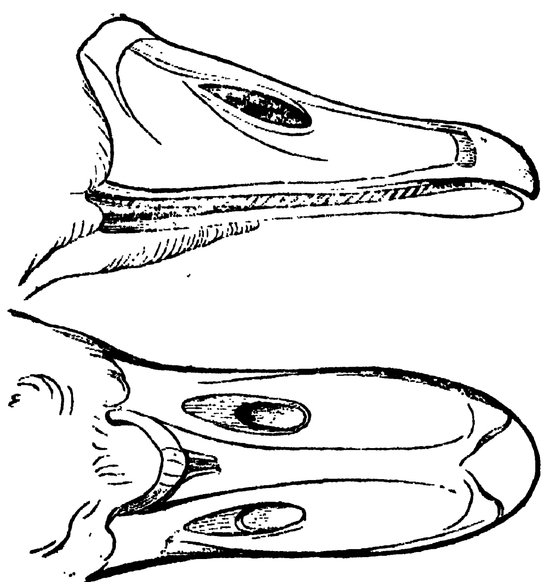
The following cuts will in some degree illustrate the form of the bill in the Geese.



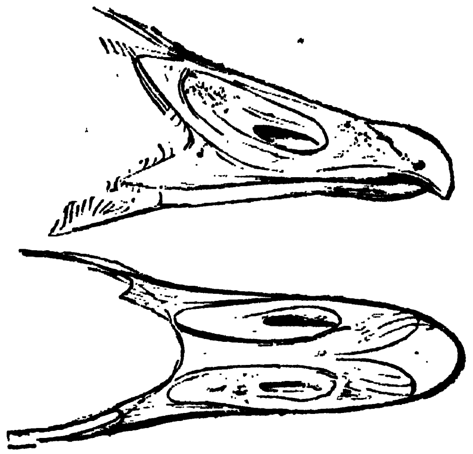
Bill of Anser Hyperboreus, Snow Goose.



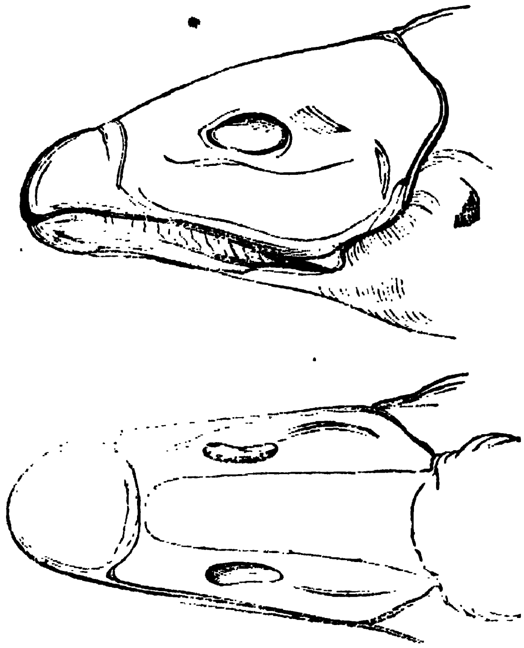
Bill of Grey Lag, or Common Wild Goose.



Bill of Chenalopex Ægyptiacus, Egyptian Goose.



Bill of Bernicle Goose. (See Bernicle Goose, vol. iv.)



Bill of Cereopsis, Pigeon-Goose of Swainson. (See Cereopsis, vol. vi.)

Dr. Richardson gives the following description of a male *Snow Goose* (Anser hyperboreus) killed at Fort Enterprise, lat. 65°, June 1, 1821:—

Colour, white. *Quills* pitch-black, their shafts white towards the base. *Head* glossed with ferruginous. *Irides* dark hair-brown. *Bill, feet,* and *orbits*, aurora-red; *ungues* of both mandibles livid. The ferruginous tint occupies different portions of the head in different individuals, and in some extends to the neck and middle of the belly. An *immature bird* has a few feathers on the crown and nape, the fore part of the back, ends of the scapulars, some of their coverts, and the outer webs of the tail feathers greyish-brown, all tipped, and more or less edged with white. Tertiaries and rest of the plumage as in the old bird. Some individuals deviate from the full plumage merely in the bastard wing and primary coverts retaining their grey colour, while in very young birds part of the under plumage is also greyish-brown. *Bill* shaped much like that of *Anser albifrons.*

This bird, *Anser hyperboreus* of Pallas, *Anser niveus* of Brisson, appears to be the *Anas hyperborea* of Gmelin, *Anas nivalis* (Snow Goose) of Forster; *Snow Goose* of Pennant, Wilson, Bonaparte, and Nuttall; *White Brant* of Lawson, Lewis, and Clark; *Wæwæ-oo*, or *Wapow-wæoo*—(the young *Catchcatew-wæwæoo*) of the Cree Indians; *Kangokh* (plur. *Kang-oot*) of the Esquimaux; *Wavey* of the Hudson's Bay residents; *L'Oie hyperborée, ou de neige*, of the French; and *Schnee-gans* of the Dutch.

Food, Habits, Reproduction, &c.—The Snow Goose feeds principally on rushes, insects, &c., and in the autumn on berries. The rushes, roots of reeds, and other vegetables,

it tears up, according to Wilson, from the marshes like the hogs, and here its powerful strongly-serrated bill becomes a most useful instrument. Of the berries, the crow-berry, *Empetrum nigrum*, appears to be the favourite. Dr. Richardson states that this species breeds in the barren grounds of Arctic America in great numbers, and that their eggs are of a yellowish-white colour and regularly ovate form, three inches in length, and two in their greatest breadth. At the end of August the young fly, and all have departed southward by the middle of September; but it is said that the young do not attain the full plumage of the old bird before their fourth year, and until then they appear to keep in separate flocks.

Utility to Man.—In common with most of the true geese, the plumage of the Snow Goose is available for adding to the comforts of man, and its flesh, when well fed, is excellent. Dr. Richardson states it to be far superior to that of the Canada Goose in juiciness and flavour. At the time of their departure southward from Severn Fort in October, Dr. Latham says that many thousands are killed by the inhabitants, who pluck them, and, taking out the entrails, put their bodies into holes dug in the ground, covering them with earth, which, freezing above, keeps them perfectly sweet throughout the severe season, during which the inhabitants occasionally open one of these storehouses, and find the birds untainted and good. In Siberia the same mode of preserving them seems to be practiced.

Geographical Distribution, &c.—Nuttall states that the Snow Goose is common to the north of both continents. He says that early in November they arrive in the river Delaware, and probably visit Newfoundland and the coasts of the Eastern States in the interval, being occasionally seen in Massachusetts Bay. They congregate in large flocks, and are very noisy: their note is more shrill than that of the Canada Goose, and they make but a short stay in winter, proceeding farther south as the severity of the weather increases. The Prince of Musignano notes it as rare and accidental in the winter at Philadelphia. Nuttall further remarks that the Snow Geese begin to return towards the north by the middle of February, and until the breaking up of the ice, in March, are frequently seen in flocks on the shores of the Delaware and around the head of the bay. He observes that they are met with commonly on the western side of America, as at Oonalashka and Kamtschatka, as well as in the æstuary of the Oregon, where they were seen by Lewis and Clark. According to Dr. Richardson, they are numerous at Albany Fort, in the southern part of Hudson's Bay, where the old birds are rarely seen; and, on the other hand, the old birds in their migrations visit York Factory in great abundance, but are seldom accompanied by the young. The Snow Geese, he adds, make their appearance in spring a few days later than the Canada Geese, and pass in large flocks both through the interior and on the coast.

Mr. Gould, who gives a very good figure of the adult in his magnificent work on the Birds of Europe, says that the species inhabits all the regions of the Arctic Circle, but more especially those portions appertaining to North America. From the northern portions of Russia and Lapland, he adds, where it is sparingly diffused, it regularly migrates to the eastern portions of Europe, and is occasionally found in Prussia and Austria, but never in Holland. To the polar regions, he concludes, it retires as its congenial locality early in the spring, to perform the duties of incubation and rearing its young.

The *Grey Lag*, or common *Wild Goose*, is the origin of the domestic goose of our farm-yards. 'It is,' says Pennant, 'the only species that the Britons could take young and familiarize; the other two'—the *white-fronted Goose* (*Anser albifrons*) and the *Bean Goose* (*Anas segetum*, Lath. and Gmel.) [Bean Goose,] are probably the species meant—'never breed here, and migrate during summer.' The grey lag-goose, then, and the domestic goose, may be considered identical. It is the Χήν (*Chen*) of the Greeks and *Anser* of the Romans—the same that saved the capitol by its vigilance and was cherished accordingly. Pliny (lib. x., c. xxii.) speaks of the bird much at length, stating how they were driven from a distance on foot to Rome; he mentions the value of the feathers of the white ones, and relates that in some places they were plucked twice a year. 'Mirum in hac alite, a Morinis usque Romam pedibus venire. Fessi proferuntur ad primos, ita cæteri stipatione naturali propellunt eos. Candidorum alterum vectigal in pluma. Velluntur quibusdam locis bis anno. Rursus plumigeri vestiuntur: molliorque quæ corpori quam proxima, et è Germania laudatissima. Candidi ibi, verum minores, *ganzæ* vocantur. Pretium plumæ eorum, in libras denarii quini,' &c.

The domestic goose is the *Oye privée* and the wild goose is the *Oye sauvage* of Belon; *Anser ferus* and *Anser* of Gesner and others; *Anser domesticus* and *Anser palustris noster, Grey Lagg dictus* of Ray; *Anas Anser ferus* of Latham; *Anas Anser* of Linnæus. It is the *Oca* (tame), *Oca salvatica, Oca grossa col becco rosso* (wild) and *Oca Paglietane* of the Italians; *Oie domestique* and *Oie sauvage* of the French; *Oie Cendrée ou première* of Temminck; *Gans, Grau Gans* and *Wilde Gemeine Gans* of the Germans; *Gaas* of the Danes; *Gas* and *Will Gas* of the 'Fauna Suecica;' *Gwydd* of the antient, and *Goose* and *Wild Goose* of the modern British.

Though this bird is well known, there has been so much confusion in consequence of there being three species of wild goose, viz. *Anas Anser*, Lin., *Anas* (*Anser*) *segetum* [Bean Goose, vol. iv.], and *Anas* (*Anser*) *albifrons, white-fronted Wild Goose,* that it may be as well to give Pennant's description.

'This,' writes Pennant, 'is our largest species; the heaviest weigh ten pounds; the length is two feet nine inches; the extent five feet. The bill is large and elevated, of a flesh colour tinged with yellow; the nail white: the head and neck cinereous, mixed with ochraceous-yellow; the hind part of the neck very pale, and at the base of a yellowish-brown; the breast and belly whitish, clouded with grey or ash-colour; the back grey; the lesser coverts of the wings almost white, the middle row deep cinereous slightly edged with white; the primaries grey, tipped with black and edged with white; the coverts of the tail and the vent feathers of a pure white; the middle feathers of the tail dusky, tipped with white, the exterior feathers almost wholly white; the legs of a flesh colour.'

In its reclaimed state it varies, like most domesticated animals, infinitely; but it is said always to retain the whiteness of the coverts of the tail and the vent feathers: the whiter the plumage, the more it is esteemed.

Geographical Distribution.—The seas, the shores, and the marshes of the Oriental countries; rarely advancing northward above 53°; abundant in Germany and towards the centre of Europe; in very small numbers, on its passage, in Holland and France. The domestic races, all sprung from this species, multiply in all countries (Temminck). 'The grey lag is known to inhabit all the extensive marshy districts throughout the temperate portions of Europe generally; its range northwards not extending farther than the fifty-third degree of latitude, while southwards it extends to the northern portions of Africa, eastwardly to Persia, and, we believe, is generally dispersed over Asia Minor.' (Gould, *Birds of Europe*.) The Prince of Musignano notes it as rather common in winter near Rome.

Food, Habits, Reproduction, &c.—Aquatic vegetables and all sorts of seeds. 'The grey lag,' says Gould, 'assembles in flocks, and, like the bean goose, seeks the most open and wild districts, often descending upon fields of newly sprung wheat, which, with the blades of fine grasses, trefoil and grain, constitute its food.' Temminck says that the nest is made in heathy spots ('bruyères'), and in marshes, upon tussocks of rushes and dried herbs, and that the number of eggs is five, six, or eight, rarely twelve or fourteen, of a dirty greenish—Gould says sullied white. Pennant states that this species resides in the fens the whole year, breeds there and hatches about eight or nine young, which are often taken, easily made tame, and esteemed most excellent meat, superior to the domestic goose. The old geese, which are shot, are, he says, plucked, and sold in the market as fine tame ones, and readily bought, the purchaser being deceived by the size, but their flesh is coarse. Towards winter he adds, they collect in great flocks, but in all seasons live and feed in the fens.

The tame goose is very long lived. 'A certain friend of ours,' it is Willughby who relates the story—'of undoubted fidelity, told us that his father had once a goose that was known to be eighty years old, which for ought he knew might have lived the other eighty years, had he not been constrained to kill it for its mischievousness in beating and destroying the younger geese.'

Utility to Man.—One of the most useful of birds, whether we consider its flesh or its feathers. Tame geese, writes Pennant, 'are kept in vast multitudes in the fens of Lin-

coinshire; a single person has frequently a thousand old geese, each of which will rear seven, so that towards the end of the season he will become master of eight thousand. I beg leave to repeat here a part of the history of their economy from my tour in Scotland, in order to complete my account. During the breeding season these birds are lodged in the same houses with the inhabitants, and even in their very bed-chambers; in every apartment are three rows of coarse wicker pens, placed one above another; each bird has its separate lodge divided from the other, which it keeps possession of during the time of sitting. A person called a *Gozzard*, i. e. *Goose-herd*, attends the flock, and twice a day drives the whole to water; then brings them back to their habitations, helping those that live in the upper stories to their nests, without ever misplacing a single bird. The geese are plucked five times in the year; the first plucking is at Lady-day, for feathers and quills, and the same is renewed four times more between that and Michaelmas for feathers only. The old geese submit quietly to the operation, but the young ones are very noisy and unruly. I once saw this performed, and observed that goslins of six weeks old were not spared; for their tails were plucked, as I was told, to habituate them early to what they are to come to. If the season prove cold, numbers of the geese die by this barbarous custom. When the flocks are numerous, about ten pluckers are employed, each with a coarse apron up to his chin. Vast numbers of geese are driven annually to London to supply the markets, among them all the superannuated geese and ganders (called the *Cagmags*), which, by a long course of plucking, prove uncommonly tough and dry. The feathers are a considerable article of commerce; those from Somersetshire are esteemed the best, and those from Ireland the worst.'

The liver seems to have been a favourite morsel with epicures in all ages, and their invention appears to have been active in exercising the means of increasing the volume of that organ. The *pâté de foie d'oie de Strasbourg* is not more in request now than were the great goose-livers in the time of the Romans. (See Pliny, *Hist.*, lib. x., c. 22, &c.)

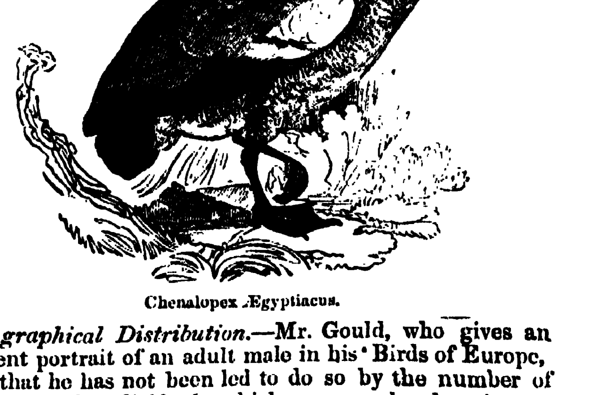
The *Egyptian Goose* (*Anser Ægyptiacus* of Brisson, *Anas Ægyptiaca* of Linnæus) appears to be the Χηναλώπηξ (*Chēnalōpex*) of the Greeks, and accordingly the modern zoologists have named it *Chenalopex Ægyptiacus* (Gould, *Birds of Europe*). Aristotle (*Hist. Anim.*, lib. viii., c. 3) mentions the *Chenalopex* as a palmipede bird haunting the banks of lakes and rivers. Aristophanes names it in two of his comedies, viz. 'Birds,' v. 1295, 'Lysistr.' v. 956. (In the 'Lysistrate' the Ravenna MS. reads Χηναλώπηξ: but Bekker prints Κυναλώπηξ, noticing the Ravenna reading.) Athenæus mentions it with praise on account of its eggs, as claiming the second place in excellence, those of the peacock holding the first (*Deipn.*, lib. ii., c. 16, p. 58). Ælian lib. v., c. 30; lib. xi. c. 38) notices it, and speaks of its cunning.

But it is Herodotus who draws our attention to the bird as one of those held sacred by the Egyptians (*Hist.*, lib. ii., c. 72), and the researches of modern travellers have fully shown that it was at least a favourite dish with the priests. It is impossible to look at the Egyptian paintings and sculptures—many will be found in the British Museum, and many more copied in Rosellini, and other works of the same kind—without being struck with the frequent occurrence of geese represented, both alive and plucked and prepared for the table. That some of these represent the *Chenalopex* there can be no doubt. The author of the interesting book on Egyptian antiquities ('Library of Entertaining Knowledge—Egyptian Antiquities,' vol. ii., London, 1836') gives a print containing, as he believes, all or nearly all the varieties of the animal forms, except perhaps the fishes, which he had been able to find on the great sarcophagus, the two obelisks, and some other monuments in the British Museum. Among them he figures a palmipede bird, which he considers to be the *Egyptian Goose*, the *Chenalopex* of Herodotus; and he observes that it is of frequent occurrence on the sculptures, though it was not a sacred bird; unless it may have some claims to that honour from having been a favourite article of food for the priests. A place in Upper Egypt, he remarks, had its name Chenoboscion, or Chenoboscia ('goose-pens'), from these animals being fed there, probably for sale; though these may have been sacred geese, for the goose, we are told, was a bird under the care of Isis. Every one recollects, he adds, the story in Livy, of the geese of Juno saving the capitol. The bird referred to, if accurately figured, and we are told that the drawing was executed with great care, seems too short upon its legs for the Egyptian goose of modern authors, and has more the air of a Bernicle.

Belon gives a fair description of the Egyptian goose among other observations he says, 'Estant de la forme d'une oye, et le col long, et la corpulence plus petite, semble estre haut eniambee;' and he applies to the bird, which he describes, the name of *Vulpanser*, or *Chenalopex*. He speaks also of its being kept 'es cours des grand seigneurs seulement.' M. Geoffroy St. Hilaire is also of opinion that the Egyptian goose is the *Chenalopex*, or *Vulpanser*, of the antients; and Mr. Stephens conferred the former generic title on the species.

Generic Character.—*Bill* as long as the head, slender, nearly straight, rounded at the tip, laminated on the margin; upper mandible slightly curved, nail hooked, lower mandible flat. Nostrils sub-basal; upper mandible margined all round with brown, reddish flesh-colour in the centre, irides orange. *Wings* with spurs. *Tarsi* elongated; the three anterior toes fully webbed; hind toe simple. Legs placed *in equilibrio* with reference to the body.

Description.—Sexes nearly similar; female rather smaller than the male, and with the colouring less intense. Narrow edging of feathers round the base of the bill, a line running nearly straight from that edging to the eye, and large patch surrounding the eye, chestnut; crown of the head, sides of the face and anterior part of neck pale buff approaching to white, gradually passing into rufous brown on the back of the neck; lower part of the neck of the same reddish tinge, which forms there a slightly marked collar. Upper part of the back light chestnut brown, rayed with very minute transverse irregular lines of dark brown approaching to black; middle of the back and upper part of scapulars dark reddish brown minutely rayed with irregular transverse lines of blackish brown and grey; lower part of scapulars and tertiaries reddish chestnut; lesser wing coverts white, except the posterior row of feathers, which are crossed with black near their extremities so as to form a narrow oblique band across the wing; primaries, lower part of the back, rump, and tail black; secondaries rich green glossed with purple. In the middle of the breast there is a large patch of deep chestnut; the rest of the under part of the body from the slight collar to the thighs pale buff with fine irregular transverse blackish brown lines. Vent and under tail-coverts rich buff. Legs and feet reddish flesh-colour.



Chenalopex Ægyptiacus.

Geographical Distribution.—Mr. Gould, who gives an excellent portrait of an adult male in his 'Birds of Europe,' states that he has not been led to do so by the number of half-reclaimed individuals which are yearly shot in our island, but from the circumstance of its occasionally visiting the southern parts of the Continent from its native country Africa. M. Temminck, he remarks, particularly mentions the island of Sicily as one of the places frequented by it, and he adds that this is the species which would appear to

have been held in great veneration by the antient Egyptians, as we frequently find a figure of it among the monuments of that celebrated people. It is, he says, abundant on the banks of the Nile, and is distributed over the whole of the vast continent of Africa.

This handsome species breeds freely in confinement, and is often seen in the aviaries and near the lakes of those who take pleasure in collecting and domesticating ornamental water-birds.

The *Spur-winged Goose*, or *Gambo Goose* (*Anser Gambensis* of Ray and others, *Anas Gambensis* of Linnæus, *Plectropterus Gambensis* of modern ornithologists), was confounded by Willughby, and afterwards by Buffon, with the Egyptian goose. It is however a very different bird, as any one will instantly perceive when he sees the two geese side by side in our menageries.

Size nearly that of the common Goose; but the *legs* are long, and placed under the middle of the body. *Bill* broad and flat, with a tubercle at the base like that of the tame swan. This tubercle increases with age. Bend of the wing armed with a large blunt spur, which is sometimes double. *Bill* and its basal tubercle dull red; sides of the *head* white; *upper parts* of body glossy black, with metallic reflections; base of the wings with a white patch mottled with black spots; *under parts* white; *legs* slightly tinged with red; *spur*, which is only visible when the wing is expanded, horn colour.

Mr. Swainson thus characterises the genus *Plectropterus*, Leach: 'Size large; wings armed with naked tubercles or spines; bill lengthened, wide at the tip; the base with a naked protuberance. Rasorial.'

Geographical Distribution.—Northern and Western Africa. More rare in collections than the Egyptian Goose, but has lived well in the gardens of the Zoological Society of London, at the Regent's Park.

The *Canada Goose*, or *Cravat Goose*, *Anser Canadensis* of authors, in its contour, especially about the neck, seems to approach the swans. Indeed, Mr. T. C. Eyton arranges it under the genus *Cygnus*. It is the *Neescah*, or *Mistehayneescah*, of the Cree Indians, *L'Outarde* of the French-Canadians, *Bustard* of the Hudson's Bay settlers, *Wild-Goose* of the Anglo-Americans, and *L'Oie à cravate* of the French.

Hearne, Pennant, Wilson, Audubon, Nuttall, and others, give very interesting accounts of the habits and chace of this species, whose annual advent furnishes such an abundant harvest of food to the residents in the countries visited by it. Our limits will not permit us to indulge in these entertaining but somewhat lengthened narratives, and we select Dr. Richardson's account as being at once clear and concise. 'The arrival of this well-known bird,' says Dr. Richardson, in 'Fauna Boreali-Americana,' 'in the fur-countries is anxiously looked for and hailed with great joy by the natives of the woody and swampy districts, who depend principally upon it for subsistence during the summer. It makes its first appearance in flocks of twenty or thirty, which are readily decoyed within gun-shot by the hunters, who set up stales, and imitate its call. Two or three, or more, are so frequently killed at a shot, that the usual price of a goose is a single charge of ammunition One goose, which, when fat, weighs about nine pounds, is the daily ration for one of the Company's servants during the season, and is reckoned equivalent to two snow-geese, or three ducks, or eight pounds of buffalo and moose-meat, or two pounds of pemmican, or a pint of maize and four ounces of suet. About three weeks after their first appearance, the Canada Geese disperse in pairs throughout the country, between the 50th and 67th parallels, to breed, retiring at the same time from the shores of Hudson's Bay. They are seldom or never seen on the coasts of the Arctic Sea. In July, after the young birds are hatched, the parents moult, and vast numbers are killed in the rivers and small lakes when they are unable to fly. When chased by a canoe and obliged to dive frequently, they soon become fatigued, and make for the shore with the intention of hiding themselves; but as they are not fleet, they fall an easy prey to their pursuers. In the autumn they again assemble in flocks on the shores of Hudson's Bay for three weeks or a month previous to their departure southwards.

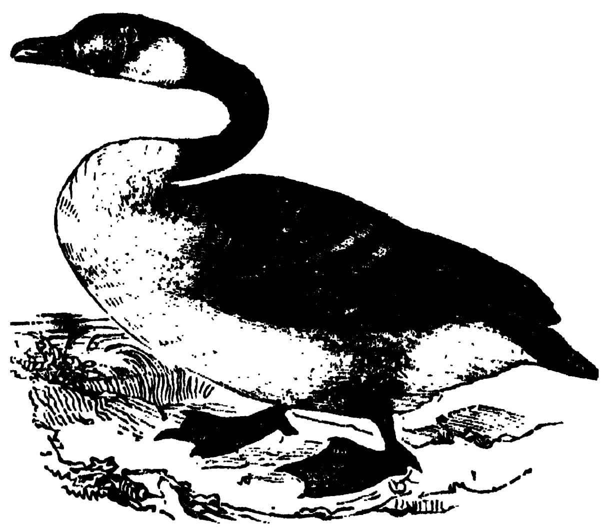
It has been observed that in their migrations the Geese annually resort to certain passes and resting-places, some of which are frequented both in the spring and autumn, and others only in the spring. The Canada Goose generally builds its nest on the ground; but some pairs occasionally breed on the banks of the Saskatchewan in trees, depositing their eggs in the deserted nests of ravens or fishing eagles. Its call is imitated by a prolonged nasal pronunciation of the syllable *wook* frequently repeated.'

Food, Reproduction, &c.—The principal food of this species consists of sedge-roots, herbage, and delicate marine plants, such as those of the genus *Ulva*. In the spring they feed on berries which have been preserved by the snow through the winter, such as those of the Silvery Buckthorn (*Eleagnus argentea*). Mr. Audubon found them breeding on the coast of Labrador; the eggs, six or seven in number, of a greenish white, are laid in a roughly-made nest. Mr. Nuttall says that in the month of March, 1810, many were nesting in the Shave-rush* bottoms of the Missouri, no farther up than Fire Prairie, considerably below the junction of the river Platte; so that the breeding range of the Canada Goose probably extends through not less than 30 degrees of latitude. The Prince of Musignano notes it as common in winter near Philadelphia, and as being an object of chase on the sea-shore in the autumn.

Utility to Man.—When it is remembered that the Hudson's Bay residents depend greatly on the supply of Canada Geese for their winter provision, and that in favourable years as many as 3000 or 4000 are said to have been killed and barrelled up, it is evident that without this aid numbers must be in a very forlorn condition. It has been asserted that on a good day a single native from the ambush of his bough hut will kill as many as 200. They are preserved in frost with the feathers on, and the flesh is juicy and nutritious, though not equal to that of the snow-goose. The feathers also are of commercial value. The bird has been long domiciled in Europe, in France, and in this country particularly, where it breeds freely, and is a great ornament. Buffon states that it bred with the swans at Versailles: it will breed also with the common goose. The produce of the latter intermixture are said to be much more delicious in flavour and quality than the unmixed progeny of the domestic goose.

Description.—*Head*, two-thirds of the neck, greater quills, rump, and tail, pitch-black. *Back* and *wings* broccoli-brown, edged with wood-brown. Base of the *neck* before and the under plumage generally brownish grey. A few feathers about the *eye*, a large kidney-shaped patch on the *throat*, the sides of the *rump* and upper and under *tail coverts* pure white. *Bill* and *feet* black.

Dr. Richardson observes that individuals differ considerably in dimensions.



Anser Canadensis.

The author last above quoted states, as a summary, in 'Fauna Boreali-Americana,' that the Geese feed on vegetable substances, pasturing by day, and retiring in the night to repose on the water. This must be taken as a general proposition, for the Canada Goose is said rarely to sleep upon the water, except in very calm weather, their roosting-place being mostly in the marshes. Dr. Richardson, in continuation, says that they swim well, but dive only when moulting and unable to fly. If pursued at such times they leave the water and try to hide themselves on shore. They

* Equisetum Hyemale, there commonly termed rushes. (Nuttall.)

fly high and swiftly, in flocks arranged in two lines meeting in an acute angle: they alight on the ground, seldom on the water. The same author observes that *Anseres albifrons* and *hyperboreus* feed chiefly on berries, and are seldom seen on the water, except in the night or when moulting; that they frequent the sandy shores of rivers and lakes in flocks, one of their number generally doing duty as sentinel, and that both species breed in great numbers in Arctic America and on the islands of the Polar Sea. *Anser albifrons* he states to be rare on the coast of Hudson's Bay, and says that it migrates over the interior, and chooses its breeding-places in the vicinity of woody tracts; whilst *Anser hyperboreus* visits both the interior and the coast in its migrations, but resorts to the barren grounds to breed. '*Anser Canadensis*,' writes Dr. Richardson in conclusion, 'is abundant in pairs throughout the fur-countries up to a high latitude. It associates in flocks only on its first arrival. It feeds on grass and on all kinds of berries. Early in the spring I have found its crop filled with the farinaceous astringent fruit of the *Eleagnus argentea*. *A. Bernicla* and *Hutchinsii* breed in considerable numbers on the shores and islands of the Arctic Sea, but keep near the sea-coast in their migrations, and are seldom seen in the interior. They feed on marine plants and on the *mollusca* which adhere to them, as well as on grass and berries. The Prince of Musignano enumerates *Anser segetum* and *A. leucopsis* in his list of American Geese; but they did not come under our notice in the fur-countries. Hutchins and Hearne speak of the *Canada Goose* under the name of *Common Grey Goose*, what they term *Canada Goose* being our *A. Hutchinsii*.'

This sort of practical information is not merely interesting in a philosophical point of view: the observations which Dr. Richardson's opportunities enabled him to make become of great practical importance, when it is considered that upon the habits and migratory movements of this useful tribe depend the comfort, nay, almost the existence, of multitudes of human beings. We shall therefore follow these birds through Dr. Richardson's 'Table;' and we would earnestly entreat all zoological travellers to keep such registers whenever their position will enable them to add such valuable contributions to natural history. The Table from which the following extract is made embraces the whole of the birds comprised in the 'Fauna Boreali-Americana.' Dr. Richardson remarks that the fourth column is taken from the Prince of Musignano's 'Specchio Comparativo,' (a design which we understand the Prince is carrying out to a much more general conclusion in a work for which we are anxiously looking), and that the fifth column is filled up on the authority of that naturalist, Wilson, Audubon, and some others.

Species.	Extreme Northern range. Distribution in the Fur countries. Whether resident or migratory.	Species observed on the Saskatchewan; lat 53° to 54° N., and from 600 to 1000 miles distant from the sea-coast.	Species that frequent the vicinity of Philadelphia, lat. 40° N. (Bonaparte.)	Winter Quarters of the Species.
Anser albifrons	Lat. N. 73°. East of Rocky Mountains. *Migratory.*	*Passage.* Spring and Autumn. In flocks. Very abundant.	Winter, Accidental visiter.	Middle and Southern States.
—— hyperboreus	73°. Across the Continent. *Migratory.*	Ditto. Ditto. Ditto.	Ditto. Ditto.	United States.
—— Canadensis	70°. Ditto. *Migratory.*	Summer. Common.	Ditto. Common.	Middle States.
—— Bernicla	73°. East of Rocky Mountains. *Migratory.*	*Passage.* Spring and Autumn. Accidental.	Ditto. Ditto.	Southern States.
—— Hutchinsii	69°. Ditto. *Migratory.*	Ditto. Ditto. In flocks.		

With regard to the further geographical distribution of this useful tribe, the reader will find *Anser Indicus, Barred-headed Goose*, Lath., *Anser melanotos, Black-backed Goose*, Lath., and *Anser Coromandeliana, Anas Girra*, Gray and Hardw., *Girra Teal*, Lath., in the catalogue of birds which were collected on the Ganges between Calcutta and Benares, and in the Vindhyian hills between that place and Gurra Mundela, on the Nerbudda, by Major James Franklin, F.R.S., &c. (*Zool. Proc.*, 1830-31.) *Anser Girra, Anas Girra*, Gray, called the *Cotton Teal* by the Europeans in Deccan, on account of the quantity of white in the plumage, appears also in the account of Colonel Sykes's collection of birds from the Deccan. (*Zool. Proc.*, 1832.) *Anser inornatus* is recorded among the birds brought home from the Straits of Magalhaens by Captain Phillip Parker King, R.N. (*Zool. Proc.*, 1830-31.) Mr. Gould, in his 'Century of Birds from the Himalaya Mountains,' figures *Anser Indicus* as occurring there.

Some interesting information as to the tracheæ, &c., of *Anser Magellanicus* and the Egyptian Goose, given by Mr. Yarrell, will be found in *Zool. Proc.*, 1833.

We have now endeavoured to give the student a general sketch of the tribe of Geese. The limits of this article preclude an enumeration of all the species; but it is hoped that enough has been stated to direct the reader who would wish to follow out the subject in all its details.

FOSSIL GOOSE. (?)

Dr. Buckland ('Reliquiæ Diluvianæ') describes and figures, from the clay in which the remains of Elephant and Rhinoceros are so often found, the humerus of a bird in size and shape nearly resembling that of a Goose, and in the same state of high preservation with the Hyæna and Rhinoceros bones amidst which it lay. 'This,' says Dr. Buckland, 'is the first example within my knowledge of the bones of birds being noticed in the diluvium of England.'

GOOSEBERRY, the *Ribes Grossularia*, indigenous to Britain and some other European regions of cool temperature, and also to the mountains of North America, at an elevation of from 2000 to 3000 feet above the level of the sea, is the origin of the many hundreds of kinds of this wholesome fruit now in cultivation. Some authors refer the varieties to two species, *Ribes Grossularia*, the *rough* Gooseberry, and *Ribes Uva-crispa*, the *smooth* Gooseberry; others consider the latter as being merely a variety of the former; and certainly this is most correct, since it has been proved, from the results of successive reproductions, that the rough will sometimes become smooth, and the contrary. The name of Gooseberry has most probably been applied from the fruit being made into a sauce, and used for young or green geese. Its use, as is well known, is more or less within the reach of every one. It is the earliest fruit for culinary preparations; and it may be preserved green for winter use, as also in a ripe state. The plant bears so abundantly that a large quantity may be thinned off for tarts, pies, sauces, &c., in the early part of the season, and still, if done judiciously, a sufficiency left for ripening. The gooseberry will ripen in the extreme northern parts of Britain, near the level of the sea; and in lat. 57°, even at an elevation of 900 feet, it acquires great perfection with regard to flavour. In hot seasons, in the southern counties, the fruit cannot endure full exposure to the direct rays of the sun, which sometimes make it appear as if scalded; under such circumstances evaporation takes place from the whole surface faster than the subjacent tissue can repair the loss: the consequence of which is a complete emptying of the superficial cells of the fruit, which produces death.

The temperature and other circumstances which various species of fruit require in the course of ripening are very important to be known, as they vary in all probability in every different species. In some cases the secretions are formed rapidly; growth is moreover quick from the period of flowering; and a rapidly-increasing temperature, attended by atmospheric moisture, is best suited to the perfection of the fruit: such is the case with the apricot. The fig, on the contrary, demands a long, steady, high temperature, and a dry atmosphere.

In the case of that now under consideration, it appears that the flavour is best where the low temperature of the north brings the fruit more gradually to maturity than it does in the south, where the fruit is in danger of being scorched, and where it ripens far too quickly to acquire the

peculiar flavour which it attains in its favourite climate; and a different method of pruning and training ought to be practised accordingly. Thus in the north the branches should be left thin, so as to expose the fruit, and with the same view the spurs should be short. In the south the trees should not be laid so open, and the lateral young shoots, instead of being cut close in, immediately above the fruit-bud at their base, should have two buds left to produce leaves for shading the fruit in summer.

In the manufacturing districts of Lancashire and the adjoining counties the cultivation of the gooseberry has been brought to surprising perfection, at least as regards the size of the fruit; and this chiefly by the manufacturing classes, in consequence of prizes being awarded to successful competitors at the gooseberry-show meetings. Judging from the quality of the varieties grown for competition in this way, it appears that weight is the only qualification required; it is however much to be regretted that flavour is not also taken into account. From the neglect of this requisite many of the fine Lancashire gooseberries are not at all worth cultivation except on account of their coming to a size sufficiently large for cooking earlier than the smaller. For this purpose those with smooth skins should be avoided, because the skins become tough in the process of cooking.

For flavour, the small, or 'Old English' kinds, are far the best, and indeed are the only sorts worth growing; but they do not look well among a dessert. We give below a list of such sorts as are proper for a selection, when flavour is the principal object; and another in which mention is made of the best Lancashire varieties, where flavour and size are in a tolerable degree combined. Those who wish for more extensive information will find such in a table published in the 'Guide to the Orchard and Kitchen Garden,' which includes upwards of 700 sorts, distinguishing their colours and the respective weights to which 200 of the principal prize sorts have been grown in different seasons, together with the number of prizes each has obtained.

Gooseberries are arranged systematically according as their *colours* are *red, yellow, green*, or *white:* and subdivided with regard to their *surface* being *hispid, downy*, or *smooth.*

Small, or Old English, Gooseberries

Division 1. FRUIT RED.
* *Surface hispid.*
1. Rough Red.
2. Small Red Globe.
3. Small Dark Rough Red.
4. Scotch Best Jam.
5. Red Champagne
6. Keen's Seedling.
7. Raspberry.
8. Red Warrington.
9. Rob Roy.

*** *Surface smooth.*
10. Red Turkey.

Division 2. FRUIT YELLOW.
* *Surface hispid.*
11. Early Sulphur.
12. Yellow Champagne.
13. Hebburn Yellow Aston.

** *Surface downy.*
14. Rumbullion.

*** *Surface smooth.*
15. Amber.
16. Yellow Ball.

Division 3. FRUIT GREEN.
* *Surface hispid.*
17. Early Green Hairy.
18. Glenton Green.
19. Hebburn Green Prolific.

*** *Surface smooth.*
20. Pitmaston Green Gage.
21. Green Walnut.

Division 4. FRUIT WHITE.
* *Surface hispid.*
22. White Crystal.
23. White Champagne.
24. Taylor's Bright Venus.

** *Surface downy.*
25. Early White.

*** *Surface smooth.*
26. White Damson.
27. White Honey.
28. Crystal.

Of the above, Nos. 1, 3, 4, 5, 7, are excellent for preserving. No. 14 is the best sort for bottling green. The earliest are Nos. 9, 11, 17, 21, 25, 27; and the latest is No. 8.

Large, or Lancashire, Gooseberries.

Division 1. FRUIT RED.
* *Surface hispid.*
Leigh's Rifleman.
Lomas's Victory.
Melling's Crown Bob.
Boardman's British Crown.
Bratherton's Huntsman.

** *Surface downy.*
Berry's Farmer's Glory.

*** *Surface smooth.*
Farrow's Roaring Lion.
Rider's Scented Lemon.

Division 2. FRUIT YELLOW.
*** *Surface smooth.*
Dixon's Golden Yellow.

Division 3. FRUIT GREEN.
* *Surface hispid.*
Princess Royal.
Hopley's Lord Crewe.

** *Surface downy.*
Parkinson's Laurel.
Collier's Jolly Angler

*** *Surface smooth.*
Massey's Heart of Oak.
Edwards's Jolly Tar.
Large Smooth Green.

Division 4. FRUIT WHITE.
* *Surface hispid.*
Cleworth's White Lion.

** *Surface downy.*
Woodward's Whitesmith.
Wellington's Glory.
Saunders's Cheshire Lass

*** *Surface smooth.*
Cook's White Eagle.

The pruning of Gooseberries is performed any time during the winter, and before the sap begins to be in motion in the spring. The operation consists in removing all cross laterals, so as to leave the branches as nearly as possible at regular distances, round an open centre, except where the heat of the climate renders it necessary to retain branches in the centre for shade; and the points of these branches, where too extended, or weak, should also be shortened to some well situated bud. Very strong shoots, assuming the character of robbers, should be cut clean out, except such as may be occasionally wanted to supply vacancies. It is however better economy, with regard to the health of the tree, to pinch off the tops of these strong shoots in the summer, and thus prevent their monopolizing the sap from the other parts. Suckers, on the same principle, should be prevented from growing at the root.

The branches in all cases should be pruned to a single terminal shoot. In short, the plant should exhibit a regular appearance without any overcrowding in one part and deficiency in another

GORCUM. [HOLLAND.]

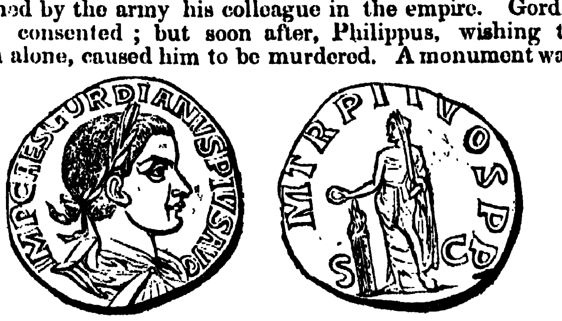
GORDIA'NUS, MARCUS ANTONIUS AFRICANUS, born under the reign of the first Antoninus, of one of the most illustrious and wealthy families of Rome, made himself very popular during his quæstorship by his munificence and the great sums which he spent in providing games and other amusements for the people. He also cultivated literature, and wrote several poems, among others one in which he celebrated the virtues of the two Antonines. Being entrusted with the government of several provinces, he conducted himself so as to gain general approbation. He was proconsul of Africa in A.D. 237, when an insurrection broke out in that province against Maximinus, on account of his exactions, and the insurgents saluted Gordianus as emperor. He prayed earnestly to be excused on account of his great age, being then past eighty, and to be allowed to die in peace; but the insurgents threatening to kill him if he refused, he accepted the perilous dignity, naming his son Gordianus as his colleague, and both made their solemn entry into Carthage in the midst of universal applause. The senate cheerfully confirmed the election, proclaiming the two Gordiani as emperors, and declaring Maximinus and his son to be enemies to the country. Meantime however Capillianus, governor of Mauritania, col-

Coin of Gordianus the Younger.
British Museum. Actual size. Copper. Weight, 369½ grains.
The inscription on the obverse of the two medals is the same.

lected troops in favour of Maximinus, and marched against Carthage. The younger Gordianus came out to oppose him, but was defeated and killed, and his aged father, on learning the sad tidings, strangled himself. Their reign had not lasted two months altogether, yet they were greatly regretted, because of their personal qualities, and the hopes

which the people had founded on them. The younger Gordianus was 46 years of age, was well informed, and had written several works. He is charged with being too much addicted to women. The senate, on hearing the news of their death, elected Balbinus and Maximus in their place to oppose the ferocious Maximinus. [Balbinus.]

GORDIA'NUS, MARCUS ANTONIUS PIUS, grandson by his mother of the elder Gordianus, and nephew of Gordianus the younger, was 12 years of age when he was proclaimed Cæsar by general acclamation of the people of Rome, after the news had arrived of the death of the two Gordiani in Africa. The senate named him colleague of the two new emperors Maximus and Balbinus; but in the following (A.D. 238, according to Blair and other chronologists) a mutiny of the prætorian soldiers took place at Rome, Balbinus and Maximus were murdered, and the boy Gordianus was proclaimed emperor. His disposition was kind and amiable, but at the beginning of his reign he trusted to the insinuations of a certain Maurus and other freedmen of the palace, who abused his confidence, and committed many acts of injustice. In the second year of his reign a revolt broke out in Africa, where a certain Sabinianus was proclaimed emperor, but the insurrection was soon put down by the governor of Mauritania. In the following year Gordianus, being consul with Claudius Pompeianus, married Furia Sabina Tranquillina, daughter of Misitheus, a man of the greatest personal merit, who was then placed at the head of the emperor's guards. Misitheus disclosed to Gordianus the disgraceful conduct of Maurus and his friends, who were immediately deprived of their offices and driven away from court. From that moment Gordianus placed implicit trust in his father-in-law, on whom the senate conferred the title of 'Guardian of the Republic.' In the next year news came to Rome that the Persians under Sapor had invaded Mesopotamia, had occupied Nisibis and Carrhæ, entered Syria, and, according to Capitolinus, had taken Antioch. Gordianus, resolving to march in person against this formidable enemy, opened the temple of Janus, according to an antient custom which had been long disused, and, setting out from Rome at the head of a choice army, took his way by Illyricum and Mœsia, where he defeated the Goths and Sarmatians, and drove them beyond the Danube. In the plains of Thrace however he encountered another tribe, the Alani, from whom he experienced a check, but they having also retired towards the north, Gordianus crossed the Hellespont and landed in Asia, from whence he proceeded to Syria, delivered Antioch, defeated the Persians in several battles, retook Nisibis and Carrhæ, and drove Sapor back into his own dominions. The senate voted him a triumph, and also a statue to Misitheus, to whose advice much of the success of the emperor was attributed. Unfortunately however that wise counsellor died in the following year, under the consulship of Arrianus and Pappus, not without suspicions of foul play being raised against Philippus, an officer of the guards, who succeeded him in the command. In the year after, A.D. 244, Gordianus advanced into the Persian territory, and defeated Sapor on the banks of the Chaboras; but while he was preparing to follow him, the traitor Philippus, who had contrived to spread discontent among the soldiers, by attributing their privations to the inexperience of a boyish emperor, was proclaimed by the army his colleague in the empire. Gordianus consented; but soon after, Philippus, wishing to reign alone, caused him to be murdered. A monument was



Coin of Gordianus Pius.
British Museum. Actual size. Copper. Weight, 228 grains.

raised to him by the soldiers, with an inscription, at a place called Zaitha, 20 miles east of the town of Circesium, not far from the left bank of the Euphrates, which continued to be seen until it was destroyed by Licinius, who assumed to be a descendant of Philippus. Gordianus was about 20 years old when he died; his body, according to Eutropius, was carried to Rome, and he was numbered among the gods. His short reign was a prosperous one for Rome. (Capitolinus in *Historia Augusta*; Herodian, book viii.)

GORDON, THOMAS, was born at Kirkcudbright, in Galloway, about 1684, received his education at one of the Scotch universities, and came early to London, where he gained a livelihood by teaching languages, and by political authorship. It is said that he was employed by the earl of Oxford. He is best known by his translation of Tacitus, 2 vols. fol., 1728-31, a scholar-like work, which has been referred to by Brotier as an authority in explaining doubtful passages. It is stiff and often ungraceful, from the author's desire to follow the order of words in the original as far as possible; but is on the whole the best translation of Tacitus in our language. Gordon also translated Sallust, with Cicero's four Orations against Catiline, 4to., 1744. Both works are accompanied by Political Essays.

Mr. Gordon in early life seems to have held democratic principles, which recommended him to the friendship of Mr. Trenchard, a gentleman of family and fortune, well known in the political world, whose widow ultimately became Gordon's wife. Conjointly they published a collection of papers, once of celebrity, called 'Cato's Letters,' also the 'Independent Whig.' It is said however that Gordon, after his friend's death in 1723, was gained over to the support of Walpole: and it is certain that he held the office of commissioner of the wine licences. He died in 1750. There are two collections of his tracts: 'A Cordial for Low Spirits,' 3 vols.; and 'The Pillars of Priestcraft and Orthodoxy shaken,' 2 vols., both posthumous. Little seems to be known concerning him; the fullest account we have seen is in Chalmers' 'Gen. Biog.'

GORDON, WILLIAM (born at Hitchin, Herts, in 1729, died at Ipswich in 1807), an Independent minister, emigrated in 1770 to America; and in 1772 was appointed minister of a church in Roxbury, Massachusetts. He attached himself warmly to the revolutionary cause, and became chaplain to the provincial congress of the colony. After the conclusion of peace he returned to England, where in 1788 he published his 'History of the Rise, Progress, and Establishment of the Independence of the United States of America.' It is cast into the form of a correspondence, in letters from America to Europe, and *vice versâ*. The first letter contains a useful compendium of the history of the thirteen original States, from their establishment to the beginning of the war. The author professes to have applied himself from 1776 to the collection of materials; to have had access to the state records; and to have been favoured by generals Washington, Gates, Greene, and others, with a liberal examination of their public and private papers. It will be obvious that a history written on the plan described is not likely to possess much value, except as a collection of contemporaneous evidence. The author is reported to manifest a strong anti-English bias. We have not ourselves examined the work.

GOREE is a small island near the western coast of Africa. It lies along the southern shores of the tongue of land with which Cape Verd projects into the Atlantic, 14° 17′ N. lat. and 16° 55′ W. long. It is separated from the continent by the strait of Dakar, which is about 3000 yards across. The island consists of volcanic rocks, partly covered with sand, with which has been mixed vegetable mould, brought from the continent. It belongs to the French, who have erected some fortifications and a small town; but its importance has disappeared with the abolition of the slave-trade on this part of the coast. (Goldberry's *Fragments*.)

GORGE, in fortification, is the name given to that part of any work which lies directly between the interior extremities of its faces or flanks, as between *f* and *g*, *fig.* 1, Bastion.

The prolongations of the magistral lines of two collateral ramparts or walls, till they meet in the interior of any work, as *f* B, *g* B, are called the demi-gorges of that work.

GO'RGIAS, of Leontini, in Sicily, celebrated among contemporaries as a statesman, sophist, and orator, belongs to the most brilliant period of the literary activity of Greece, and has been immortalized by the Dialogue of Plato which bears his name. The dates of his birth and death are alike uncertain, but the number of his years far outran the ordinary length of human existence, and in the different statements ranges between 100 and 109. Whatever may have been the speculative errors of Gorgias, his long life was remarkable for an undeviating practice of virtue and tem-

perance, which secured to his last days the full possession of his faculties, and imparted cheerfulness and resignation to the hour of death.

According to Eusebius, Gorgias flourished in the 86th Olympiad, and came to Athens (Olymp. 88, 2, or B.C. 427) to seek assistance for his native city, whose independence was menaced by its powerful neighbour Syracuse. In this mission he justified the opinion which his townsmen had formed of his talents for business and political sagacity, and upon its successful termination withdrew from public life and returned to Athens, which, as the centre of the mental activity of Greece, offered a grand field for the display of his intellectual powers and acquirements. He did not however take up his residence permanently in that city, but divided his time between it and Larissa in Thessaly where he is said to have died shortly before or after the death of Socrates.

To the 84th Olymp. is assigned the publication of his philosophical work entitled 'Of the Non-being, or of Nature' (περὶ τοῦ μὴ ὄντος ἢ περὶ φύσεως), in which, according to the extracts from it in the pseudo-Aristotelian work 'De Xenophane, Zenone, et Gorgia,' and in Sextus Empiricus, he proposes to show, 1st, that absolutely nothing subsists 2nd, that even if anything subsists, it cannot be known and 3rd, that even if aught subsists and can be known, it cannot be expressed and communicated to others. His pretended proof of the first position is nothing less than a subtle play with the dialectic of the Eleatæ, as carried out to its extreme consequences by Zeno and Melissus. There is much more of originality in the arguments which he advances to support the other two: thus, in respect to the second, he urged that if being is conceivable, every conception must be an entity, and the non-being inconceivable while, in the third case, he showed that as language is distinct from its object, it is difficult either to express accurately our perceptions or adequately to convey them to others. Now, however sophistical may have been the purpose for which all this was advanced, still it is no slight merit to have been the first to establish the distinction between conception and its object, and between the word as the sign of thought and thought itself. By thus awakening attention to the difference between the subject and the object of cognition, he contributed largely to the advancement of philosophy.

In these arguments however, and generally in his physical doctrines, Gorgias deferred in some measure to the testimony of sense which the stricter Eleatæ rejected absolutely as inadequate and contradictious: on this account, although the usual statement which directly styles him the disciple of Empedocles is erroneous, it is probable that he drew from the writings of that philosopher his acquaintance with the physiology of the Eleatic school.

Subsequently it would appear that Gorgias devoted himself entirely to the practice and teaching of rhetoric; and in this career his professional labours seem to have been attended both with honour and with profit. According to Cicero (*de Orat.*, i. 22 ; iii. 32), he was the first who engaged to deliver impromptu a public address upon any given subject. These oratorical displays were characterized by the poetical ornament and elegance of the language and the antithetical structure of the sentence, rather than by the depth and vigour of the thought; and the coldness of his eloquence soon passed into a proverb among the antients. Besides some fragments, there are still extant two entire orations, ascribed to Gorgias, entitled respectively, 'The Encomium of Helen,' and 'The Apology of Palamedes,' two tasteless and insipid compositions, which may however not be the works of Gorgias. On this point consult Foss (*De Gorgia Leontino Commentatio*, Halle, 1828), who denies their authenticity, which is maintained by Schönhorn (*De Authentiâ Declamationum quæ Gorgiæ Leontini nomine extant*, Breslau, 1826).

GORGO'NIA. [ZOOPHYTARIA.]

GORGONOCE'PHALUS. [STELLIRIDEA.]

GORGONS, GO'RGONES, is the name of certain mythological personages, which in their vulgar acceptation were represented as three daughters of Phorcys, a marine god, and his wife Ceto. Their names were Medusa, Euryale, and Stheno. Many wild and discordant stories were told of them, such as their having great wings, sharp crooked claws, teeth like the tusks of the wild boar, and snakes instead of hair, and one eye among the three, and yet some poets have represented one of them, Medusa, as a very fascinating creature. (Ovid, *Metamorphoses*, b. iii.) The Gorgons were represented as living in the farthest west, beyond the limits of the known world; others placed them in the unknown regions of Libya. They were said to have had the power of turning into stone all those who gazed at them. At last Perseus, the son of Jupiter and of Danaë, set out, encouraged and assisted by Minerva, to encounter the Gorgons, and he conquered them, cut off the head of Medusa, from whose blood, dropping on the ground, the horse Pegasus was engendered. He then gave the head of Medusa to Minerva, who fixed it on her ægis or shield, which ever after had the power of turning the beholders into stone.

GÖRLITZ, a westerly circle of the Prussian province of Silesia, forming part of Upper Lusatia, and bounded south and west by the kingdom of Saxony, has an area of 338 square miles, and contains about 48,900 inhabitants. It is very mountainous in the south. It contains only one large river, the Neisse, but a number of small streams. It is less an agricultural than a manufacturing country, and rears much cattle.

GÖRLITZ (Solerz, in the Wend language), the chief town both of the circle and of the former margraviate of Upper Lusatia, is a fortified place on the left bank of the (Lusatian) Neisse, lying at an elevation of 665 feet above the level of the sea, in 51° 9′ N. lat. and 15° 1′ E. long. There is a bridge over the Neisse; the main streets are broad and straight, and the number of houses is about 1200, and of inhabitants about 12,100. The principal buildings are—the castle; eight churches, all Protestant (of which the high church of St. Peter and St. Paul is built in a rich and noble style; the town-hall, exchange, high school, three libraries, an orphan asylum, a seminary for female teachers, four hospitals, a house of correction, and the church of the Holy Cross. Among the manufactures are woollens, which employ 300 looms; linens, stockings, leather, hats, buttons, &c., tobacco-pipes, woollen yarns, iron-ware, and musical instruments. Görlitz has a considerable wholesale and transit trade. In conjunction with the remainder of Upper Lusatia, it was separated from Saxony, and transferred to Prussia in the year 1815.

GÖRTZ, a large circle in the government of Trieste and kingdom of Illyria, bounded on the east by Carniola, and south by Trieste. Its area is 966 square miles, and it contains 3 districts, 5 municipal and 5 market-towns, 441 villages, and a population of about 175,000 (in 1830, 168,236; and 1825, 162,926). Nearly the whole of this circle is a valley enclosed by the Alps; it is watered by the Isonzo and Idriza; and produces wine, silk, flax, hemp, fruit, and a small quantity of corn.

GÖRTZ, or GORIZIA, the chief town of the circle, is situated on the left bank of the Isonzo, and spreads along the sides of the Schlossberg, a ruinous castle, once the residence of the counts of Görtz, in 45° 57′ N. lat. and 13° 29′ E. long. It contains about 730 well-built houses, and 9700 inhabitants. It is the seat of a bishopric, and has four churches, besides a cathedral, with an episcopal seminary. The Attems family possesses the well-known 'Roman stone,' which affords evidence that the antient Norica stood in the vicinity of this town. Görtz has large silk spinneries and manufactories of silks, dyeing establishments, bleach-grounds for wax, &c.

GORUCKPORE. [OUDE.]

GOSHAWK. [FALCONIDÆ, vol. x., p. 178-9.]

GOSLICKI, LAURENTIUS, a learned Pole, who lived in the sixteenth century. Having commenced his studies at Cracow, he continued them at Padua, where he published his work 'De Optimo Senatore,' which was printed at Venice, and published at London, 1733, 4to., under the title of the 'Accomplished Senator Laurentius Goslicki Bishop of Posnania, done into English by Wm. Oldisworth. The translator gives in his notes a parallel between the Polish and English constitutions. Goslicki entered the church, became bishop of Posnania, and was frequently employed in many political affairs.

GOSPEL, derived from two Saxon words of the same meaning as the Greek *evangélion* (εὐαγγέλιον), which signifies 'good news,' is employed both by the authors of the New Testament and by modern theologians to denote the whole Christian system of religion, and also more particularly the good news of the coming of the Messiah. The books containing an account of the life of Christ were also

called gospels by the ecclesiastical writers. Many such gospels were in circulation in the first three centuries, but four only, namely Matthew, Mark, Luke, and John, were received by the fathers as of divine authority. Several of the other gospels are quoted by the fathers, but not as possessing authority to bind the faith of Christians; and Origen, who appeals to them more than any other writer, expressly says that the church received only four gospels. (*Hom. in Luc.*, i. 1.) We find no quotations from them in the writings of the apostolical fathers, with the exception of a doubtful passage in Irenæus (Lardner's *Works*, vol. ii., p. 91): none of them appear to have been written till the second century, and several not till the third. The apocryphal gospels which had the widest circulation were, the Gospels according to the Twelve Apostles, the Hebrews or Nazarenes, and the Egyptians. The Gospel according to the Hebrews, which is supposed by some critics to be the same as that according to the Twelve Apostles, was written, in all probability, in the beginning of the second century, in the Syriac language. It appears to have been taken principally from St. Matthew's Gospel, with additions from the other evangelists and oral tradition. It has been maintained by some critics that this gospel was written by St. Matthew, and that the Greek gospel bearing his name in the New Testament was only a translation of it. [MATTHEW.]

The Apocryphal Gospels which are extant are, 'The Gospel of the Infancy of Christ,' alleged to have been written by Thomas; the 'Gospel of the Birth of Mary;' the 'Protevangelion of James,' and the 'Gospel of Nicodemus.' These were published by Fabricius, in his 'Codex Apocryphus Novi Testamenti,' 2 vols. 8vo., Hamb. 1719-1743, and by Jones, with an English translation, in his 'Method of settling the Canonical Authority of the New Testament,' 3 vols. 8vo. Lond. 1736-7. These gospels appear to have been written with the object of supplying the supposed deficiencies of the canonical gospels. They abound in absurd and improbable tales, principally relating to the early life of Christ, and contain hardly any particulars concerning his public life and ministry. The writings of the fathers give the names of many other gospels, of which the following is an alphabetical list:—Andrew, Apelles, Barnabas, Bartholomew, Basilides, Cerinthus, Ebionites, Encratites, Eve, Jude, Judas Iscariot, Matthias, Marcion, Merinthus, Peter, Philip, Scythianus, Tatian, Thaddæus, Thomas, Valentian. (Jones *on the Canon*, vol. i., p. 145-150.)

From the many verbal agreements and striking differences in the gospels of Matthew, Mark, and Luke, it has been maintained by many critics that they were derived from an original gospel common to them all, which is supposed to have been drawn up by the disciples who attended the person of Christ; and that this document, which was afterwards lost, is quoted by Clement and Origen under the title of 'The Gospel according to the Twelve Apostles.' This hypothesis was first introduced into this country by Dr. Marsh, in his dissertation 'On the Origin of the first three Gospels,' and has been maintained in Germany by Michaelis, Semler, Lessing, Eichhorn, Gratz, Kuinoel, Bertholdt, and other celebrated critics. An interesting account of this controversy is given in the preface to the English translation of Schleiermacher's 'Critical Essay on the Gospel of St. Luke,' Lond. 1825, 8vo.

GOSPORT, a seaport and fortified town in the Portsdown division of Hampshire. It is situated within the parish of Alverstoke, and on the western side of Portsmouth Harbour, near its entrance, 73 miles south-by-west from London. In the reign of Henry VIII. it is described by Leland as a mere village, inhabited by fishermen. It is now a market-town of importance, and in time of war is a place of great activity. Gosport is subject to the jurisdiction of the county magistrates. About the beginning of the present century it was strengthened by a line of bastions which extend from Weovil to Alverstoke. The Royal Clarence Yard, within the lines, contains the brewery, victualling department, &c., from which the Royal Navy are supplied. The coasting trade is considerable. There are several distilleries, and an extensive iron foundry, where chain cables and anchors are made. The market-days are Tuesday, Thursday, and Saturday. Gosport is a chapelry to the neighbouring village of Alverstoke, and is in the diocese of Winchester, the living being a curacy worth 100*l.* per annum, in the gift of the rector of Alverstoke. The rectory of Alverstoke is in the patronage of the bishop of Winchester, and has an average net income of 1287*l.* The chapel is spacious and neat, and stands to the south of the town, in the centre of a cemetery well stocked with shrubs. Besides an almshouse there are several charity-schools supported by voluntary donations. Near the extremity of the point of land which forms the west side of Portsmouth Harbour is situated the Royal Hospital of Haslar, founded at the suggestion of the earl of Sandwich, and erected between the years 1750 and 1762. The ordinary expenses of this establishment, which is intended exclusively for the reception of sick and wounded seamen, is about 5000*l.* per annum, and it contains accommodations for more than 2000 patients. The portico of the centre building is surmounted by the royal arms, and by two figures representing commerce and navigation. The population of Gosport with Alverstoke was 12,637 in 1831, and had much increased in consequence of the removal of the victualling establishment from Portsmouth. Gosport is a polling-place for the southern division of the county.

Bingham Town is a populous suburb, containing many genteel residences; and Anglesea, about two miles from Gosport, on Stoke's Bay, is a new and fashionable watering-place (*Parliamentary Papers; Beauties of England and Wales*, Lysons' *Britannia*.)

GOSSELIES. [HAINAULT.]

GOSSELIN, P. F. J., a distinguished geographer, born in 1751, at Lisle. From 1772 to 1780, he travelled in different parts of Europe engaged in geographical and antiquarian researches. At the beginning of the revolution he was returned by his province as a deputy to the national assembly, and in 1791 nominated by the king a member of the central administration of commerce. The Committee of Public Safety employed Gosselin in the department of war. In 1799 he received a place in the cabinet of medals at Paris, which he retained till his death in 1830. His principal works are 'Géographie des Grecs analysée,' Paris, 1790, in quarto, with 10 maps, and 'Récherches sur la Géographie systematique et positive des Anciens,' 4 vols., Paris, 1798 to 1813, in quarto, with 54 maps. The researches contained in these works throw great light on the geographical knowledge of the antients. Gosselin also assisted in the translation of Strabo, which was undertaken by the order of the French government, and published at Paris, 1805 to 1819, in 5 vols.

GOSSY'PIUM, a genus of plants of the order Malvaceæ, common to both the old and the new world, and which, from the hair, or cotton, enveloping its seed being so admirably adapted for weaving into cloth, is, after those affording food, one of the most important groups of plants. There can be no doubt that it is indigenous in America, as, besides the distinctness in species, specimens of cotton still attached to the seeds, as well as cloth fabricated from the former, have been brought by Mr. Cumming from the Peruvian tombs. Some of the cloth, consisting of chequered squares of black and white, very nearly resembles some modern patterns. Humboldt has moreover stated that it formed the only clothing of the natives of Mexico, and is one of the plants they most antiently cultivated. With respect to the old world, the almost universal use of cotton as clothing in the East is well known; and as the species, so far as ascertained by botanists, appear to be Indian and Chinese, the historical investigation is interesting as proving an early communication between the civilized nations of remote antiquity. Though Rossellini incorrectly states that cotton was employed as mummy-cloth, it must have been known to the antient Egyptians, as he found some of the seed in one of the monuments of Thebes. In later times, we learn from Arrian that muslin was exported from India to the Arabian Gulf, and from that country cotton was no doubt first made known to the rest of the world.

The Sanscrit name of the cotton-plant is *karpasi*, and the Hindee *kupas*; the cotton itself is in the latter language called *rooi*. The former is interesting, as '*karpasus*' occurs in the 'Periplus' of Arrian, and is rendered by Dr. Vincent *fine muslin*. It is derived from the Sanscrit *karpasi*, from which probably, as indicated by the editor of Harris's Dictionary, the Hebrew word *karpas*, employed in the book of Esther (chap. i., v. 6), is also derived; so likewise the Latin *carbasus*. Dr. Royle, in his 'Essay on the Antiquity of Hindoo Medicine' (note, p. 145), infers, that as in the above passage of Esther, white, green, and blue hangings fastened to pillars of marble are described in the court of the garden of the king's palace; the practice appears similar to what is now adopted in India, where calico cur-

tains, usually in red and white stripes, and stuffed with cotton (commonly called *purdahs*), are employed everywhere in India, and at Delhi even in the king's hall of audience. This consists of colonnades of pillars supporting a light roof in the court before the private apartments of the palace. On the outer rows of pillars these purdahs are suspended; hence, the author infers, we may understand the use to which were applied the rows of pillars in front of the palace in the ruins of Persepolis

Cotton was no doubt in later times cultivated and manufactured into cloth. Pliny (lib. xix., c. 1) states that Upper Egypt produces a small shrub which some call *gossypion*, others *xylon*, bearing fruit like a nut, from the interior of which a kind of wool is produced, from which very white and soft cloth is manufactured. Had it been common in Egypt in the time of Herodotus, it could not have escaped him; as he says specially of the Indians, that they possess a kind of plant which, instead of fruit, produces wool of a finer and better quality than that of sheep: of this the natives make their clothes. Nearchus describes the dress of the Indians as being made of flax from trees ('Library of Entertaining Knowledge,' *Egyp. Antiq.*, ii., p. 125). Theophrastus (lib. iv., c. 9) clearly describes the cotton with leaves like the vine as being abundant in the Island of Tylos in the Persian Gulf. Heeren, in his work on the 'Commerce of the Antients,' comes to the conclusion that these plantations of cotton in the Island of Tylos were the result of the commerce with India, the true country of the cotton. The inferences from these quotations of the original introduction of cotton from India into Egypt are in some measure confirmed by there being no species of Gossypium indigenous and peculiar to the latter country. In conclusion it is necessary to refer to the facility with which cotton is distinguished from linen to controvert the assertion of Rossellini that it was always employed for mummy-cloth; as the result of numerous observations by Bauer, &c., with the most powerful microscopes of modern times, and every variety of mummy-cloth, has proved that it is invariably composed of linen, and not of cotton cloth. The one fibre is easily distinguished from the other; that of cotton having a flat tape or riband-like appearance, while the fibre of the linen has a round tubular and even-jointed structure. (*Egyp. Antiq.*, 'Library of Entertaining Knowledge,' vol. ii., p. 182.)

The genus Gossypium is characterised by having a double calyx, of which the inner is cup-shaped, obtusely 5-toothed, the outer or involucre tripartite, with the leaflets united at the base, cordate, with the margins irregularly cut. Stigmas, 3-5. Capsules, 3 or 5 celled, many seeded. Seeds clothed with wool-like hairs, or cotton.

The species of Gossypium occupy naturally a belt probably exceeding the torrid zone in breadth, but in a cultivated state we have cotton now extending on one hand to the south of Europe, and Lower Virginia and even Maryland, in the United States of America; while on the other, we have it as far south as the Cape of Good Hope, and in America to the southern parts of Brazil. Within these limits it may also be seen cultivated at considerable elevations. Baron Humboldt mentions having seen it even at 9000 feet of elevation in the Equinoctial Andes; and in Mexico, at 5500 feet. Dr. Royle states it as being cultivated in small quantities at 4000 feet of elevation in 30° N. lat. in the Himalayas. The localities suited to the production of cotton depend as much upon the climate as the soil, and also upon the specific peculiarities of the different kinds of cotton plants. That the production of cotton is so much influenced by external circumstances is not more remarkable than in many other cultivated plants; indeed we might expect it to be more so from the susceptibility of this hairy development to the influence of situation. [COTTON.] Humboldt has remarked that *Gossypium barbadense*, *hirsutum*, and *religiosum* flourish in a climate where the mean annual temperature is from 82° to 68°; but that *G. herbaceum* is successfully cultivated where, the summer heat being 75° or 73°, that of winter is not less than 46° or 48°. The cultivation of this cotton however does not depend so much on winter cold as on sufficient length of suitable summer heat. The thermometer in Upper Virginia is sometimes as low as zero of Fahr. in winter, and yet cotton can be cultivated during the long summer.

It is remarkable that a genus so important for its product, and so long known, and with comparatively so small a number of species, should yet have these undetermined. The celebrated De Candolle states, that no genus more urgently requires the labours of a monograph from a careful botanist who could have the opportunity of seeing the species in a living state. The confusion has in a great measure proceeded from botanists absurdly neglecting the cultivated in their search for new species; and cultivators being incompetent or unwilling to distinguish varieties from species; frequently raising the former to the rank of the latter, because the produce, in which alone they are interested, happened to be more or less valuable. In the proceedings of the East Indian Committee there is an interesting letter from Mr. Spalding, where he informs us that the American cultivators confine their attention to such plants as are of annual growth. 1st. The *Nankeen cotton*, introduced at an early period. This is abundant in produce; the seed covered with down, the wool of a dirty yellow colour, and usually low priced. 2nd. The *green-seed cotton* with white wool, which, with the former, is grown in the middle and upland districts, whence the latter is called *upland cotton*, also *short staple cotton*, and, from the mode in which it was cleaned, *bowed Georgia cotton*. 3rd. The *sea-island* or *long-staple cotton*, which is distinguished by the black colour of its seed, and the fine white strong and silky long staple by which it is surrounded. This is grown in the lower parts of Georgia and South Carolina near the sea, and on several small islands which are not very distant from the shore.

The species admitted by botanists are not yet clearly determined. M. de Candolle, the most recent systematic author, admits thirteen species, and notices others. Two have since been described by Dr. Roxburgh, one by Ræusch, and another in the 'Flore de Senegambie.' Of varieties Mr. Bennet says he knows more than 100 kinds, and that they appeared to him never-ending. Dr. Royle, the most recent author who has treated expressly of the species, admits eight species, in which are absorbed some of De Candolle's; while others are avowedly unnoticed for want of materials for satisfactory determination. But from his own observations, Dr. Roxburgh's 'Flora Indica,' as well as from Swartz, 'Observ. Bot.' for the West Indies, and the specimens, though few, in the British Museum, it is probable that several of the cultivated species are correctly determined.

G. herbaceum, Lin., which is herbaceous in temperate, and usually with bi-triennial stems 4-6 feet high in tropical countries, is no doubt the Xylon s. Gossypium antiquorum, and includes also the *G. indicum* of Lamarck, which would indeed be the preferable name for this species. The younger parts of the stem, as well as the flower- and leaf-stalks, hairy and marked with black spots. Leaves hairy, palmate, 3- generally 5-lobed, lobes broad and rounded with a little point, or in the woody varieties sublanceolate and acute. Stipules falcate, lanceolate. Flowers of a lively yellow colour, with a purple spot near the claw. Segments of exterior calyx dentate, sometimes entire. Capsules ovate, pointed, 3- or 4-celled. Seeds free, clothed with finely adhering greyish down under the short-staple white wool.

This and its varieties are those chiefly cultivated in India. It has been procured from China and the Malayan Peninsula, and also from Egypt. *G. punctatum*, from Senegambia, is probably a variety. It is that cultivated in the Mediterranean region, and must have been the species taken to America from Smyrna.

G. arboreum, Lin. Stem arboreous 15-20 feet, sometimes shrubby, young parts hairy, tinged of a reddish colour. Leaves palmate, 3- or 4-lobed, hairy, dotted with blackish spots of a dark-green colour; lobes elongated, lanceolate, sometimes mucronate, sinus obtuse, glands one, sometimes three. Stipules oval-shaped. Flowers solitary, with short peduncles, red, with a yellowish tinge near the claws. Leaflets of the exterior calyx cordate, ovate, entire, sometimes dentate. Capsule ovate-pointed, 3- or 4-celled, seeds covered with a greenish-coloured fur, enveloped in fine silky yellowish-white wool. This species is found in the island of Celebes and in every part of India. It is noticed among lists of the plants of Arabia and also of Egypt. It is planted near temples and the habitation of Faqueers in India, and is stated to be sacred to the Hindu deities, and therefore employed only for making muslin for turbans. The species is marked *G. religiosum* in 'Heyne's Herbarium,' and one specimen of *G. barbadense* is marked *G. arboreum* in the 'Linnean Herbarium.'

G. religiosum. Perennial; stem 3-4 feet, branches and petioles a little velvetty, hirsute towards the apex, and covered

with black points. Leaves cordate, superior 3-lobed, inferior 5-lobed, deeply divided; lobes ovate-acuminate, entire pubescent (some of the lower ones ovate-acuminate), one to three glands. Stipules lanceolate, deciduous (cordate acuminate, Roxb.). Flowers large fulvous, peduncles short, dotted. Leaflets of the exterior calyx large, cordate-acuminate, deeply laciniate, hairy and dotted. Capsule ovate-acuminate, dotted, 3- 4- or 5-celled. Seeds black, covered with firmly adhering short tawny fur, under the long tawny-coloured wool.

There is considerable confusion with respect to the species which should be called *G. religiosum*. The distinguishing characteristic of what is considered such at present is the having *tawny*-coloured instead of *white* wool. There are at least two distinct localities for this kind of cotton, one Siam, the other China. From the latter country it was introduced both into India and America, under the name of *nankin cotton*. Dr. Royle is of opinion that two distinct species yield tawny-coloured cotton; one with small velvetty-looking leaves and much dotted in every part, of which he has seen specimens from Macao, Otaheite and Guzerat. The other is a much larger plant, with the general appearance and leaves of *G. barbadense*, of which there are specimens in the 'East Indian Herbarium.' Mr. Wilkinson has brought specimens from Egypt of a rather tawny-coloured cotton, with brownish seed, free from fur, which he says is there called *gotun Hindee*.

G. hirsutum, Lin. Shrubby, about six feet high, young pods very hairy. Leaves, the upper undivided, cordate, acute; the lower 3- or 5-lobed; lobes ovate, acute (triangular, Roxb.), hairy on the under and smooth on the upper surface. Petioles very hairy, dotted with black spots; glands 1 or 2 to 3; stipules lanceolate (Cavanilles); corol, base yellow, purplish towards apex (uniform yellow, Roxb.); exterior calyx ovate-acute, very hairy, cordate, 3-toothed, (Cav. laciniate, Roxb.); capsule large, ovate-acute; seeds many, free, clothed with firmly-adhering green down under the fine long white wool. (Swartz.) This species is cultivated in Jamaica, according to Swartz; and would appear, from the description of the seed, to be the green-seeded short-staple, or upland cotton of the Americans.

Gossypium barbadense.

1, branch with full and half-blown flowers; 2, capsule burst open, showing the cotton in three divisions corresponding with the cells of the capsule; 3, a seed enveloped with cotton.

G. barbadense. Stem shrubby, 6-15 feet, smooth; leaves, the upper 3-lobed, the lower 5-lobed; lobes ovate, acute, smooth, often pubescent on the under surface; leaflets of exterior calyx large, deeply laciniate; flowers yellow; capsule ovate, acuminate, smooth; seeds 8-12, free, oblong, black, and without any other pubescence than the long fine easily-separable cotton. Swartz describes this species as extensively cultivated in the West Indies: it is also the *G. vitifolium* of Cavanilles. It is one of the cultivated cottons of Egypt.

It is more than probable that the Sea-island, or long staple cotton, is a variety of this species, as its seeds agree in character. More than this it is not possible to say, as, among the numerous collections which London contains, strange to say, there are none in which genuine specimens of cultivated cottons, properly named, can be seen; but it is to be hoped that travellers and naturalists will be induced to pay a little more attention to the products of a country, whether natural or the result of art, and deposit them in our museums, with the plants which produce them.

For further information the reader is referred to the works quoted above, and to Royle's 'Illustrations of the Botany, &c., of the Himalayan Mountains,' as already referred to under the article COTTON, and to which work we have been indebted for the account of the cultivated species of Gossypium.

GOTHA, formerly the capital of the duchy of Saxe-Gotha, upon the extinction of the direct line of ducal princes in 1825 came to the duke of Saxe-Coburg. [COBURG.] Gotha is on the river Leina, on an eminence 756 feet above the level of the sea, and at the foot of the hill upon which stands the ducal palace of Friedenstein; in 50° 57′ N. lat., and 10° 42′ E. long. It is one of the handsomest towns in Saxony, and perhaps in Germany, and since the ramparts have been taken down and laid out in public walks presents an open cheerful appearance. Its form is a long irregular quadrilateral; it has four gates, five public squares, sixteen principal streets, and above 1260 houses. The streets are well paved and lighted. The population in 1817, without the garrison, was 11,080; at present it is upwards of 13,000.

The principal public buildings are the ducal palace of Friedenstein, which stands on the summit of a high hill, with a terrace like that of Windsor Castle, and is surrounded by gardens and pleasure-grounds: the upper cross of the western tower is 1298 feet above the level of the sea. It contains the ducal library of 20,000 volumes, and the national library of 60,000 volumns, and 2000 MSS., among which are fourteen folio volumes of St. Bernard's Correspondence, and 500 Arabic MSS. Its collection of coins is one of the most celebrated in Europe, and comprises 10,000 antient and 52,000 modern coins; the gold coins alone are estimated at an intrinsic value of more than 4000*l*.; a library of works on Numismatics of 6000 volumes, among which are twenty folio volumes, containing 9000 drawings of coins by Jacopo de Strada; an Oriental museum, the only one of the kind in Germany; a gallery of above 1500 paintings, including some masterpieces by L. Cranach, and collections of antiquities, the fine arts, natural history, &c. Its archive contains 3500 records. The other buildings of note are, the arsenal, the old and new town-hall, house of assembly of the States, and seven churches (the principal of which are St. Margaret's, with the ducal vaults, and the church of the Orphan Asylum), all of which belong to the Lutherans. The Gymnasium, founded in 1524, is one of the best in Germany; it has nineteen teachers, a library of 5000 volumes, and the Cœnobium, where twenty-four scholars are boarded and lodged. Gotha has many day and Sunday schools for the instruction of the poor—one for soldiers; a free school for drawing; a school for apprentices, founded in 1818 by the Society of Innungshalle; a Sunday-school for journeymen mechanics and apprentices, maintained by the Society for the Encouragement of the Arts; an institution for the training of schoolmasters, which is the oldest in Germany, &c. The 'Gotha Court Calendar,' first published in 1774, was the earliest book of the kind. The different establishments for the poor, which are very well conducted, consist of three hospitals, two military hospitals, a poor-house and infirmary, and an asylum for females of the higher class.

The majority of the inhabitants of Gotha are dependent on the court, the gymnasium, and the garrison, for their subsistence. The rest are engaged in the manufacture of

muslins and cottons, which employ above 400 hands; and in that of porcelain, paper, cloth, linen, thread, yarn, camlets, tobacco, musical and surgical instruments, toys, pewter and japan goods, furniture, gunpowder, excellent saddlery, &c. Their breweries are extensive, and they are likewise famous for their sausages. A considerable trade is also carried on by the merchants of Gotha. As the environs of Gotha possess a very fertile soil, many of the inhabitants are occupied in agriculture and the rearing of cattle; it also possesses some clever artists and mechanics, and is the residence of many eminent literary characters. It is the birth-place of the poet Gotter, who died in 1795, and of Blumenbach. Near the town is the fine Observatory, built by Duke Ernest II., on the Seeberg, a hill which is 1192 feet in height. It was the scene of the labours of Zach.

GOTHARD, ST. [ALPS.]

GÖTHE, JOHANN WOLFGANG VON, was born at Frankfort-on-the-Main in the year 1749. The history, or rather the poetical account, which he has given of his own life in the book entitled 'Aus meinem Leben,' enables the reader to trace from early childhood the mental development of this extraordinary man. The taste of his father (who was a man in comfortable circumstances) for literature and works of art, and the sensation created by the breaking out of the Seven Years' War, had a great influence on his mind, and had the effect of forming him to habits of reflection. In early years he seems to have had anxious thoughts about religion, and before he had attained the age of eight he devised a form of worship to the 'God of Nature,' and actually burned sacrifices. Music, drawing, natural science, the study of languages, all had charms for him; and to further his proficiency in language, he wrote a romance, wherein seven sisters corresponded, each in a different tongue. He soon turned his attention to poetry, and composed songs for the amusement of some young persons with whom he had become accidentally acquainted. These young persons however turned out to be bad characters, and his connexion with them was broken off. The intimacy led to his feeling for the first time the passion of love. Gretchen (Peggy), who gave a name to the heroine of 'Faust,' was the object of his early passion; she was related to one of his young friends, and seems to have been a sensible well-inclined girl, who would have warned him from her own circle of acquaintance. After the connexion was broken off, he never saw her again: a severe fit of illness was the consequence of this separation. Shortly after his recovery he was sent to the university of Leipzig, where Gottsched, who favoured the French school, Ernesti, and Gellert, were leading men. Here his decided poetical turn first became manifest; and though his father designed him to study jurisprudence, instead of devoting himself to this pursuit, he looked around him, in order to learn or discover some satisfactory theory of poetry. But it was the infancy of German literature: he could find no certain criterion of taste, and this prompted him to look within himself. 'Here began,' says he, 'that tendency, from which I did not depart all my life, to turn everything which pleased or pained me into a song.' A little piece called 'Die Laune des Verliebten' (The Lover's Whimsicality*) appeared at this time, as well as a comedy called 'Die Mitschuldiger' (the accomplices), which was designed to exhibit the immorality of private life concealed under a smooth outside. He also paid attention to the history of the fine arts: Winckelmann was his favourite author. He even made some attempts at etching; but the exhalations of the acid impaired his health, and he had hardly recovered in 1768, the year in which he left Leipzig. To restore him to strength, he was sent to the residence of a lady named Klettenberg, the 'fair saint' whose confessions are recorded in 'Wilhelm Meister.' She was a mystic: her society led Göthe to study the alchemical and cabalistic authors; and he even had thoughts of founding a new religion, to be based on the Alexandrian philosophy. These strange pursuits made him turn his attention to natural science; and when he went to Strasburg to finish his legal studies, he neglected jurisprudence for chemistry and anatomy. Here he became acquainted with Herder, who advised him to peruse the Italian poets. On his return home he published the play of 'Götz von Berlichingen' (1773) and the novel of 'Werther' (1774), which excited a sensation over all Germany. The Prince of Weimar made his acquaintance, and on assuming the government invited him to his court. He went to Weimar in 1775, and in 1779 was made a privy counsellor (geheimrath), and in the same year accompanied his prince to Switzerland. In 1786 he travelled into Italy, where he remained two years. Subsequently he became one of the ministry, received honourable marks of distinction from different sovereigns, and closed a long life, devoted entirely to science, literature, and art, in 1832.

* It is difficult to find an English word which exactly corresponds to 'Laune.' The barbarous expression 'humoursomeness' might be coined for it. It means here the mood of one who is in ill-humour about nothing.

As this brief sketch of Göthe's life has not given a view of the order of his works, we shall here notice them nearly in their chronological arrangement.

'Werther,' which was one of his earliest productions, was occasioned by the suicide of a young gentleman named Jerusalem. It is written with immense power and energy, of which the flat English translation gives a very inadequate idea.

'Götz von Berlichingen' is less a drama than a series of dramatic scenes, which give an almost pictorial view of the times of the Emperor Maximilian. The character of Martin Luther, yet a monk, the Bauerkrieg (war of the peasants), the Fehmgericht, or secret tribunal, are exhibited with a graphic accuracy which, considering the age of the author, is wonderful. The character of Götz, an old German knight, who lives to see civil rights overpower the old club-law, is most interesting, while his fate excites our deepest sympathy. The characters of Adelaide, an intriguing court-lady, and Francis, an amorous page, display great knowledge of human nature. A translation of this piece was one of Sir W. Scott's earliest works.

The drama of 'Egmont' is immortalized by the character of Clara, which is a most beautiful picture of feminine constancy and devotion.

These works, together with a variety of small poems, may be reckoned as the prototypes of one class of his writings. The small poems are the exact illustration of that habit which has been already noticed. A single thought, and that a very trivial one, often forms the sole subject of a lyrical piece; yet these thoughts are so true to nature, and are so perfectly suited to the subject, as to render these little effusions perhaps the most delightful of all his works. To the same class may be referred 'Clavigo,' a domestic tragedy, and 'Stella,' a sentimental comedy with rather an equivocal moral.

The second order of works consists of those which were written at a later period of life, the prototypes of which are classical models. 'Iphigenia auf Tauris' stands at the head of this class, and is universally admitted to breathe a more truly Greek spirit than any work of modern times. It is a master-piece of its kind; the antiquity of its aspect does not consist in a blind regard for antient forms, for it has not even the chorus of the antient drama, but the very thoughts are cast in a classic mould. Professor Hermann, of Leipzig, has turned parts of this drama into Greek. 'Torquato Tasso' is another piece of the same kind, which represents the contrary positions of a poet and a man of the world. His 'Epigrams from Venice' and his 'Elegies' also bear the classic stamp, and, though frequently licentious, are excellent as being a repetition of the spirit of the Roman elegiac and amatory poets.

Three works of Göthe stand prominently forth, which it is difficult to place in any class; these are 'Wilhelm Meister's Apprenticeship,' 'Hermann and Dorothea,' and 'Faust.' The first is a novel, which contains many valuable critical remarks (particularly on Shakspeare's 'Hamlet'), but its main purpose is to exhibit the progress of a young man who, though at first ignorant of the world and filled with the most romantic ideas, ends with being an accomplished gentleman. Many of the scenes give curious pictures of German life, and the character of Mignon has been the origin of Sir W. Scott's Fenella in 'Peveril of the Peak,' and of Esmeralda in Hugo's 'Notre Dame.'

'Hermann and Dorothea' is a kind of idyllic epos; the subject is merely a love story in a small town; the pictures are drawn from humble life, but the style is Homeric, and the plot artfully interwoven with the French Revolution. J. H. Voss had previously written his idyll 'Luise' also in hexameters, and in imitation of the Greek style; but Hegel, late professor of philosophy at Berlin, ingeniously pointed out the difference between the two works, and showed that 'Luise' is a mere domestic idyl, while the subject of 'Hermann and Dorothea' is not so exclusively con-

fined to family life as to shut out the prospect of the important events of Europe.

'Faust' is a work too generally known, and requires too particular a comment to be dwelt on here. It is sufficient to say that it represents the agony of a student who is toiling after knowledge beyond his reach, and who afterwards deserts his studies and plunges into a course of sensuality. This remarkable work exhibits all Göthe's various tendencies as it were concentrated into one focus. [FAUST.]

A new form of the old poem of 'Reynard the Fox,' in hexameter verse, a number of small dramatic pieces, and, above all, the delightful biography entitled 'Aus meinem Leben,' possess the highest merit.

The later writings of Göthe, such as the second part of 'Faust,' 'Pandora,' &c., exhibit little of his former power. They are generally pedantic imitations of antique forms, without a true poetic spirit. Oriental scholars however admire his 'West-eastern Divan,' a collection of poems in the Persian style; and there are some beauties in the novel 'Die Wahlverwandschaften' (The Affinities).

To understand Göthe's greatness, we must observe that he may almost be regarded as the creator of German literature. Before his time little had been written in the language that was characterized by a decided superiority of thought or style. During the whole of his long life he was in correspondence with the chief authors of his day, and he thus exercised no small direct influence on the literary labours of others.

The universality of Göthe's genius is one of the most striking parts of his literary character. No writer ever attempted such a variety of kinds, and succeeded in all. In 'Götz' we find an historical dramatist going beyond Shakspeare in irregularity; in 'Werther,' that species of sentiment which used to be called 'German' some thirty years ago; and in 'Iphigenia', the strictest attention to Greek rules of art, and a polished elegance which an Athenian would have admired. Notwithstanding his ardent pursuit of every branch of literature, he was scarcely less distinguished for proficiency in every species of natural science, to which a number of scientific works, with his 'Theory of Colours' at their head, bear testimony.

He was enthusiastic in his admiration of the beautiful wherever it could be found, whether in poetry, painting, architecture, music, engravings, statues, or gems, and has left numberless aphorisms of the greatest value to those who cultivate the fine arts. No petty jealousy seems to have stood in the way of this admiration for the beautiful; to the works of every class and of every country he gave what he considered their due tribute of praise.

He has been blamed for having mingled too little in practical life, and for not attending sufficiently to the interests of his country; but probably he knew his capacities better than his judges, and felt that by cultivating the taste of his countrymen he was conferring a more important benefit than by mixing in politics. A very good poet may be a very bad politician.

In life and opinions he was a decided aristocrat, though raised from a comparatively humble station. While he admitted the insincerity, he admired the elegance of the court; and as he always shone in polished society, it is no great wonder that he preferred it.

Though many of his poems are highly metaphysical, he had never penetrated deeply into the philosophical writings of his countrymen. The works of Spinosa had a great influence on his religious opinions: he loved to consider the Deity rather in than beyond nature; and of this pantheistic tendency many of his works are exponents.

There is perhaps no author in the world whose mind we have such an opportunity of studying accurately as that of Göthe. Not only have we his numerous works, every one of which illustrates some peculiar mental state; not only have we a biography by himself, but there is also a host of publications containing correspondences, characteristics, and conversations, all throwing light on this great man's character, and exhibiting him in every possible relation. His correspondence with Schiller, with Zelter, with a child (Bettine Brentano), the little tracts which have been translated by Mrs. Austin and published under the name of 'Characteristics of Göthe,' and the conversations with Echermann (a sort of German Boswell), are replete with amusement and instruction. Probably more of those works may yet be published, and, as an English critic of the day observes, a vast heap of materials seems to be amassing from which some future writer may compile a complete life of Göthe, or what is the same thing, a history of German literature to the year 1832.

A complete edition of Göthe's works has been published by Cotta of Stuttgart, and another very excellent and cheap edition in 5 vols. royal 8vo., at Paris.

GÖTHEBORG, commonly called **GOTHENBURG**, a town in Sweden, situated on the river Göta-elf, about three miles from the Cattegat. Opposite the town the river widens to nearly one mile and forms an excellent harbour. The town, which is built on the southern banks of the harbour, is traversed by numerous canals, which are supplied with water by a small river, called the Ländal; these canals are crossed by twenty-one bridges; of which one is ornamented with gilded statues. The houses are mostly built of stone or bricks well stuccoed. The streets are regular, and intersect one another at right angles; they are well paved, but without foot-pavements. The canals running through them being planted with trees, give to Götheborg a great similarity to many of the towns in the Netherlands. The principal church, though not very large, unites magnitude and simplicity of design, and its interior is chaste and appropriate. The town is in a very thriving state, having increased its population during this century from 15,000 to 26,700 inhabitants (in 1825). Its commerce is extensive and very active, especially with England. About 600 vessels are engaged in its trade with foreign countries, and nearly as many in that with other Swedish harbours. Its exports consist chiefly of iron and steel, timber, tar, and pitch. Many vessels are built here. The manufactures, though numerous, are on a small scale. They consist of tobacco, cotton-cloth, sugar refining, cotton printing, and brewing. The porter is in high repute, and considerable quantities of it are exported to Russia and America. In the last century many thousand tons of herrings were taken along the rocky shores of the Cattegat, north of the town; but the fish no longer visit this coast. Götheborg is the seat of the governor or landhauptman of Götheborg-Län, and of a bishop. It has some institutions for promoting knowledge and prosperity, as a scientific society, one of agriculture, and a patriotic society. There is also a grammar-school, two charity schools, a Sunday-school, and some other charitable institutions.

(Elliot's *Letters from the North of Europe*; Sir Arthur de Capell Brooke's *Winter in Lapland and Sweden*; *Letters of* Thomas Harrington.)

GOTHLAND. [SWEDEN.]

GOTHLAND, which is called by the Swedes Gottland (*i.e.* Goodland), and not Gotaland (*i.e.* Land of the Goths), is an island in the Baltic, extending more than 70 miles in length from south to north, between 56° 55′ and 58° N. lat. It lies between 18° 10′ and 19° 20′ E. lat., and is about 22 miles across, where widest. Its surface is computed to be 1118 square miles, or somewhat less than Gloucestershire: and its population at the close of 1833 was estimated at 39,800; in 1751 it was 24,562. It forms, with the small islands about it, the Län of Gottland, sometimes called Wisby Län, from the name of the chief town.

The surface of this island is hilly, and mostly covered with wood: in a few places swamps occur, but they are not of great extent. The coasts are low, and generally unbroken. The hills, whose mean elevation seems to be 200 feet or a little more above the sea, are mostly composed of sandstone and limestone. The principal articles of exportation are timber, wood, sandstone, marble, and lime. Many districts of the island are fertile and well cultivated; it is even stated that one-fifth of its surface is under cultivation, and chiefly produces rye and barley; it has also considerable hop plantations. Its horses and black cattle are of small size, but its sheep have lately been much improved. The climate is rather mild for its position in so high a latitude.

WISBY, the capital, and the seat of a bishop, is situated on the western coast, and contains about 4000 inhabitants. In the Middle Ages it was the centre of an extensive trade with all the countries round the Baltic Sea, and the commercial usages established by its merchants (known under the name of the Ordinances of Wisby) were long in force in all the northern countries: they are even by some considered as forming the basis of the English commercial law. The town during this period was very considerable, and there still exist ruins of large buildings in its neighbourhood. Wisby contains a fine Gothic cathedral. The

commerce of the present town is confined to the produce of its forests, quarries, and the exportation of rye, but it is rather active and thriving. It has a good grammar-school. About fifteen miles south of it is Klintehamn, a good harbour, whence, on certain days, a post-boat goes to Böda-hamn on the island of Oland.

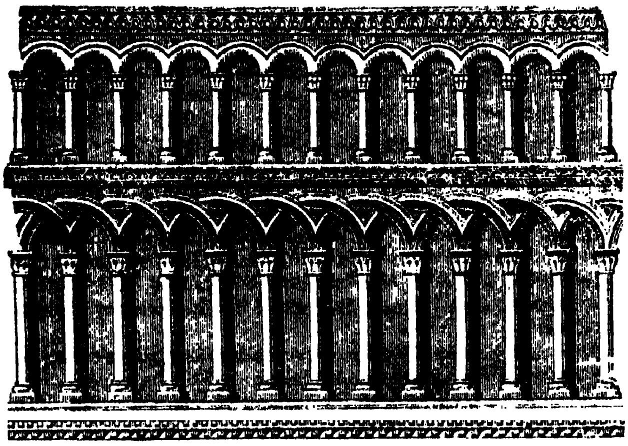
Göttland Län contains 93 churches, which gives an average of only about 428 persons to each church. (Thompson's *Travels through Sweden*; Schubert's *Reise durch Schweden*; *Statistik von Schweden*, von Carl af Forsell, Lübeck, 1835.)

GOTHIC ARCHITECTURE. This popular appellation of the style marked by the full development and consistent application of the pointed arch has been objected to, both as historically incorrect and as conveying a reproachful idea in itself. Yet although originally used in a contemptuous sense, no meaning of the kind is now attached to it; and however ill-chosen the epithet Gothic may be, however arbitrary the acceptation thus connected with it, the term is now so established, not only in our own but in other European languages, that it is useless to attempt to explode it. Even could it be effected, no real advantage would be gained by banishing it, since it misleads no one; neither has any equivalent been yet found for it, every substitute hitherto proposed being either too vague or too limited in meaning. The term 'Christian architecture,' for instance, besides being affected, is also inaccurate, because that would equally well suit any other style, whether earlier or later, prevalent in the religious edifices of Christian countries, Saxon, Norman, or Lombardic. It would further seem to imply that the style so denominated had its rise together with Christianity itself, and was devised by its first professors in opposition to Pagan architecture; consequently, instead of correcting error, the adoption of such a name would be merely the inconvenient substitution of a new-fangled mistake in lieu of an inveterate and firmly-rooted one. The term 'Pointed architecture' is upon the whole the least exceptionable of any which have been proposed, being tolerably significant, and may therefore be allowed to be employed, not to the exclusion of the word 'Gothic,' but as a very useful synonyme, that may be used indifferently with it.

By either 'Gothic' or 'Pointed' we understand that style wherein the pointed arch, as applied to various purposes, some chiefly of construction, others of design and embellishment, becomes a leading characteristic of the edifice. The origin of this form of the arch, and consequently of the style itself, has been matter of much discussion, and has led to a variety of hypotheses, more or less plausible, but all destitute of positive historic proof, and some of them obviously absurd in their ingenuity. Forgetting that striking analogies and resemblances frequently exist where imitation is entirely out of the question, Warburton, Murphy, and Sir James Hall have all suffered themselves to be most egregiously misled by casual and superficial coincidences of such kind. The first tells us that an avenue of over-arching trees was the prototype of the aisles of our ancient cathedrals; while Murphy points to the pyramids as the source whence the builders derived the idea of spires, pinnacles, and other acuminated forms; and Sir James, with equal felicity of imagination, refers us to interlaced wicker-work as the undoubted type of the Gothic style in all its leading forms, its arched and groined roofs, its clustered pillars, its windows and their fanciful tracery. As far as exemplification of his theory goes, the last-mentioned writer has certainly brought forward much stronger proof than the other two, because he has illustrated it rather fully with drawings which prove plainly enough that wicker-work may be made to imitate the principal forms of Gothic architecture with tolerable exactness. One fatal blow to all these theories is, that instead of the resemblance to the supposed model being, as it ought, the closest and most exact in the first stages of the style said to be derived from it, the resemblance is there least of all discernible.

Whether the real origin of the pointed arch will now be ever satisfactorily accounted for and proved beyond dispute may fairly be questioned; neither would any actual advantage be derived from its being done, since we should not thereby be at all advanced in our study of the style, nor enabled to copy it with greater ability than at present. Yet although the inquiry itself is one of mere curiosity, the controversies and zealous researches to which it has given rise have proved exceedingly beneficial, both by directing attention to the subject of Gothic architecture, and by leading to the study of it, thereby diffusing a popular feeling for it. Perhaps therefore it is rather an advantage than the contrary, that instead of finding it, we have been obliged to turn and dig up the whole field in search of a concealed treasure; whereas, had they stumbled upon it, our antiquaries would probably have desisted from their toil.

The first idea of the pointed arch is supposed by Milner to have been suggested by the intersection of circular blank arches crossing each other, and employed for decoration on the faces of walls, as in the annexed specimen taken from the front of Lincoln Cathedral, which is an example of the preceding or Norman style, and where the spaces between the pillars terminate in smaller acute arches.



This conjecture has much probability in its favour; yet, even if we admit it, we find that we shall obtain merely a single and simple elementary form, which goes but a little way towards constituting the definite pointed style. The mere circumstance of apertures, whether doors or windows, being pointed, is insufficient, as is proved by casual instances of such features in buildings, to give any idea of the finished style itself; in proof of which, were it not that more modern examples might be pointed out at home—and we need look no farther than the front of Guildhall, London—we might refer to the pointed arches which occur in many Moorish and Arabian buildings, which yet, independently of that obvious peculiarity of form, have little else in common with those of Gothic architecture. The coincidence as to this solitary particular has led many to attribute the invention of the pointed arch to the Arabs, and to infer that it was borrowed by the Crusaders from the Saracens. We can only say that there is strong probability in favour of such theory; but then, if that single feature was so borrowed, the style, of which it afterwards became so distinguishing a characteristic, is altogether European, unless we also suppose the tracery of Gothic windows to be derived from a similar source, and that the idea of it was first furnished by the ornamental open lattice-work so common in Oriental buildings, and some of whose complicated intersections have been thought to have suggested the pointed arch itself. What however contradicts the notion of Gothic tracery having so originated is, that such embellishment does not mark the earlier Gothic style, as it may reasonably be supposed would have been the case had it been imported, together with the pointed arch itself, from a distant country.

Notwithstanding the perplexing conflict of opinions as to the origin and formation of the Gothic style, more than one of which may be partially correct, because a great variety of circumstances may have contributed more or less towards the same end, there is one thing which admits of no doubt, namely, that the style suddenly sprung up about the close of the twelfth century, and showed itself, not in one country alone, but throughout the principal part of Europe. Still, this very fact itself has served in no small degree to increase perplexity, since, while it seems to point to some model borrowed in common from elsewhere, it has given rise to much dispute as to the country in which it first appeared. The honour of its parentage has been claimed for England, France, and Germany, by antiquaries of the respective countries. The late Mr. Hope, on the contrary, in his 'Historical Essay on Architecture,' a work which, although left in an unfinished state, brings together a vast mass of information on the subject, has put forward much able argument to show that preference of claim

ought to be assigned to Germany; while a living writer of that country, Wetter, in his 'History of Mentz Cathedral' (1837), contends that priority of date, in regard to the adoption and development of this style, belongs to France. The same writer further says that the pointed arch had come into vogue in many parts of Italy long before it was generally applied in Germany; so early, in fact, as the latter half of the eleventh century; and he cites as authority for such assertion the cathedral at Terracina (completed in 1074), and the transept of that at Amalfi (1103). Mere dates however are to be received with much caution in regard to very early examples of the style; it being very doubtful, in many cases, whether the buildings may not have undergone much alteration subsequently to their first erection. Many structures exhibit an intermixture of Gothic with the preceding style, either in consequence of such alterations, or from being incipient attempts in passing from one mode of building to the other. It is further to be remarked that, although it is clearly and broadly marked by a generic physiognomy that cannot possibly be mistaken, the pointed style belonging to each country exhibits, particularly in its later stages, numerous minor peculiarities both as to detail and masses, including distinctive differences of proportions, arrangement, and general design. It is on this account that even the mere historical study and classification of the numerous varieties of Gothic is rendered, if more interesting, infinitely more complex and intricate, not to say laborious, than that of Grecian architecture. Not only are the examples of it so abundant that a mere catalogue would amount to several thousand subjects, but almost every one of them would be found to offer some one individual peculiarity; while many of the larger edifices, separately taken, display greater diversity of forms and combinations than exist in all the remains of Grecian buildings put together. As will be seen by referring to our article on CIVIL ARCHITECTURE, the temples of the Greeks (and of their other buildings few have been preserved to us) were exceedingly simple and uniform in plan, being almost universally a parallelogram, either entirely surrounded by columns, or having them only in front, or at both ends, the other differences being nearly confined to that of the order employed, and its details, or else being merely those of dimensions, and the adscititious embellishment of sculpture; whereas Gothic edifices are so much more complex and varied in their plans, and admit of such infinite diversity of parts in their elevations, both in regard to outline and proportions, to forms of construction and those of decoration, as to render it exceedingly difficult to draw up anything like a complete and systematic synopsis, not of the entire style, in all its subdivisions, ramifications, and changes during successive periods, but of any one of its constituent elements. To take, for instance, merely doors and windows, it would require an immense number of engravings to exhibit the specimens that might be collected from different buildings; and it is nearly the same in regard to every other of the numerous component features and members which enter into this style. In comparison therefore with Grecian architecture, Gothic is what a Cretan labyrinth is to a serpentine walk in a garden, and it may fairly be called 'a mighty maze, yet not without a plan.' As yet, notwithstanding the diligence with which the study has been prosecuted of late years, we have obtained but partial clues to its intricacies. In order to be able clearly to trace them all, it would be necessary to have, by way of chart, a copious 'parallel,' exhibiting, according to different countries, and also in chronological arrangement with regard to each, all the principal buildings, drawn to the same scale, leaving information as to details to be sought for elsewhere.

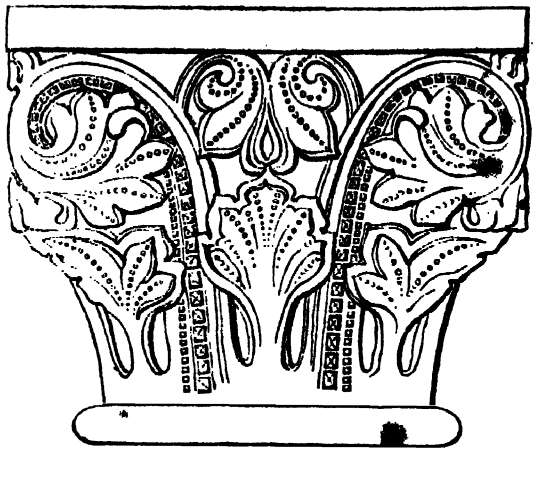
In all probability the perplexity arising from the great diversity of examples, and the difficulty of reducing them to any kind of compendious system, had no small share in leading the 'revivalists,' as they are termed, readily to adopt the antient Roman orders, as infinitely more simple, and to decry Gothic as altogether capricious and arbitrary, destitute of any fixed principles and proportions, and incapable of being reduced to any settled standard. The difficulty of becoming familiarly acquainted with it in all its bearings and all its modifications no one will dispute; at the same time no one who has any real feeling for architecture can deny its extraordinary powers and resources, or fail to be struck with admiration at its extraordinary copiousness and flexibility. Compared with this style the architectural system of the Greeks is exceedingly limited and confined in expression, and incapable of much expansion without appearing more or less evidently to be wrested from its original propriety.

Further than this we need not enter into any examination of the relative merits of the two styles, for we should be loth to advocate one at the expense of the other; nor does Gothic architecture now require to be apologized for or defended, it having been so warmly eulogized of late years, and by writers fully adequate to do justice to it.

After having said so much in regard to the difficulties arising from the vastness and comprehensiveness of the subject, which would of itself afford matter for a distinct cyclopædia, it cannot be expected that we should attempt to follow the history of this style through all its windings and crossings, from its rise to its extinction. It must suffice if we can trace a tolerably distinct though brief outline of it, and afterwards explain some of the leading forms and characteristics of the style itself. The one immediately preceding it, and from which it emanated by means of that *punctum saliens*, the pointed arch, was that known as the Norman, or by the more comprehensive title of Romanesque, it being originally no other than a still further corruption of the architecture of the Lower Empire, when columns had become mere accessories to arches, either principal or subordinate supports to them, according as their shafts were insulated, or attached to a wall or pier. For awhile this mode of building exhibited an incongruous medley of discordant parts barbarously put together, without any regard to their original intention, and without any endeavour to reconcile them with one another. Such was the case in Diocletian's palace at Spalatro, the style of which retained such strong marks of its immediate origin as to show a clumsy imitation of the one it had taken the place of. By undergoing still further changes, so that the offensive resemblance to something better was obliterated, and all idea of the Roman orders entirely lost sight of, this mode acquired a certain degree of consistency, and under various names and with various modifications became the prevalent one,—that which, bearing the general title Romanesque, is further distinguished as Byzantine, Lombardic, Saxon, Norman, according to the people who adopted it. This style it is which, in one sense, deserves the appellation of Gothic, not because it was introduced by the Goths, but because it may be dated from about the close of the fifth century, when those barbarians overran Italy. Besides the tholus, or cupola—a feature of rather rare occurrence in Lombardic buildings—the builders employed the arch very conspicuously, and in a variety of ways, sometimes placing smaller columns and arches within a larger one. Neither did they confine themselves to the semicircular form, but often made it a greater or lesser portion of a circle, so as in the former case to approach the horse-shoe shape. Nay, if it be true that the aqueduct at Bourges was erected by Justinian II., they were acquainted with the pointed arch itself before the end of the seventh century, for it is introduced in that structure alternately with the round-headed one—a circumstance which raises a presumption that such form was first imported from the East, where it had probably originated out of mere caprice. The allowing such to have been the fact does not however take away from the west of Europe the honour of having invented the pointed style; on the contrary, it rather redounds to the credit of their skill and ingenuity that, furnished with no more than so very imperfect a hint, they should have turned it to such advantage as to make that single and simple element the germ of an entirely new style, which was shortly after matured by them into full luxuriance, consistency, and beauty.

What influence Byzantine architecture had on the Mohammedan and Moorish, and also on that of Russia, is a question foreign to our present purpose; we therefore pass on to the next branch of the Romanesque (that is post-Roman), or, as the Germans term it, Fore-Gothic (*Vor-Gothisch*) style, namely, Lombardic. Among the characteristic peculiarities of this style, the following may be enumerated as the most obvious and the most general:—columns with cylindrical shafts, and varying greatly in their proportions, some being of the average height of the Roman orders, others extremely short, either in proportion to their diameter or their capitals, or else exceedingly tall, and when attached to walls elongated into a mere rod, or vertical convex moulding, surmounted by a capital. Instances of fancifully-shaped or decorated shafts are by no means unfrequent, some being zigzaged

horizontally, or polygonal in plan, or embossed with sculpture, or either twisted or cut into spiral grooves and mouldings. Equal diversity—not to call it extravagance—prevails in the capitals, which, as far as general mass and outline go, bear some analogy to the Corinthian. Of such foliaged capitals one from the doorway of Mentz cathedral may serve as an instance, though, being a single specimen, it must not be received as a sample of the entire class.



If however some capitals are much decorated, others are nearly plain, and these are frequently in the form of an inverted cone, cut in such manner as to present four flat sides, or faces, which again are occasionally more or less ornamented. In bases there is much less variety, they being, for the most part, only a series of mouldings in rude imitation of the common attic base. But one very great singularity in this style, connected with columns, is that of placing them upon the backs of couchant animals, or other figures, which serve as pedestals to them. Whimsical as it appears to us, it may, very probably, have originated not altogether in caprice, but have been occasioned by employing materials and fragments taken from ruined edifices, where columns, being found too short for their intended situation, were raised or stilted up by being set on other fragments, for which purpose remains of sculpture may have been adopted, either because they chanced to be at hand, or because considered more ornamental and as adding richness to the column itself. Upon the same supposition we may easily account for the great variety of columns and capitals in the same building, namely, that they were ornaments collected at random from the remains of other structures, and that the irregularity thus occasioned in the first instance grew by degrees to be a matter of taste, and was adopted out of choice. Columns of the kind just specified were however by no means very usual, and are chiefly to be met with in those forming porches, or decorating the chief entrance to a church, as in that of San Ciriaco at Ancona, and in San Zeno at Verona. Although not invariably so, columns are to be understood as accompaniments to arches which spring from them; and arches applied in different ways are very predominant features of the style. Besides giving the form to doorways and windows, they were employed for decorating the faces of walls, in very nearly the same manner as in the kindred Norman style, an instance of which has been shown above. The arch itself, being semicircular, continues of the same proportions, but not so in regard to the space over which it extends, because this is sometimes very tall and narrow in comparison with the chord of the arch; in others short and wide; besides which, arches of various sizes appear in the same front. Arches again exhibit considerable diversity of decoration in their mouldings, although they are also frequently left quite plain, and without finishing of any kind, even where others are highly enriched. In many Lombardic buildings the design consists of little more than an assemblage of arches variously disposed, the apertures for windows being few and small, and destitute of ornament; and they generally form either successive tiers, one above the other, like so many blank galleries, or occur at intervals in the vertical line of the edifice. In these kinds of arcades, that which is uppermost is generally of much smaller dimensions than the one beneath it, so that two of its arches occupy no wider space than one of those below it. Another practice peculiar to this style is that of carrying a range of arches beneath a gable, ascending one above the other in the same sloping direction as the sides of the roof; instances of which occur in the front of the Duomo at Parma, and in those of the cathedral at Carrara, and the church of San Zeno at Verona, in which two latter instances however the bases of the columns are all on the same level, and consequently the columns themselves gradually increase in height as they approach the centre. The front of the cathedral at Pisa offers a double instance of the same kind in the upper, or gable story, and in the half gables over the ends of the second one, with the difference, that in the latter the pillars support merely blocks placed beneath the inclined line of the roof. We may also remark that this and several other edifices in the same city are in a style so peculiar as to have been distinguished by some as a separate one, by the name of the Pisan.

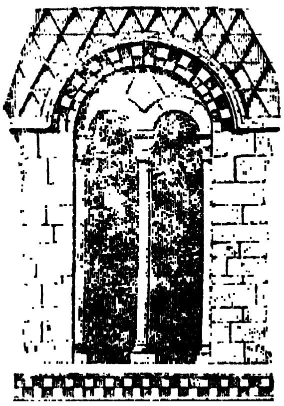
As in Norman, so too in Lombardic architecture, buttresses do not appear, for such term cannot properly be applied to the broad and slightly projecting breaks which are sometimes made on the external face of the wall. In the style we are speaking of, such projecting facings are, as frequently as not, confined to the angles, so as to form a kind of border or framing to the whole front, which is returned horizontally, or, if beneath a gable, in a sloping direction, corbelled upon small pendent arches. At other times the front is divided into several compartments of the same kind by two or more such projections intervening between the extreme ones, so that the whole forms a kind of panelling upon a large scale, which system is, in some instances, carried on by the large spaces being similarly panelled and subdivided by columns and arches. Windows, as we have said, were for the most part sparingly introduced, and of small dimensions, so that they rarely contributed at all towards embellishment; doorways, on the contrary, were made very important features, the chief ornament being lavished upon them. The aperture itself indeed was generally plain, and also square-headed, but it was enclosed in a recess formed by a series of arches one within another and resting upon columns; and so deep was this outer casing as to be frequently very nearly as wide as the actual doorway.

In the older buildings of Venice the Lombardic style appears to have combined itself with Byzantine, Saracenic, and Arabian architecture, in some instances to such a degree as to constitute one altogether *sui generis*, and peculiar to that city. While St. Mark's, with its numerous and lofty cupolas, seems to point to an immediate Byzantine origin, the façades of the doge's palace, the Ca d'Oro, and the palazzi Foscari and Pisani, with their porticos and open galleries, are strikingly Oriental in their physiognomy; for although they exhibit the pointed arch, and even trefoiled and ogive varieties of it, they do not in the slightest degree partake of the pointed style; having nothing whatever of its character in their outline or composition, which is marked by horizontal lines. Although our limits render it impossible to enter, as we could wish to do, more fully into particulars as to this very singular Venetian style, we have thought proper to direct attention to it thus briefly, as being both interesting and instructive, if merely from showing that without other elements and principles the pointed arch alone would not necessarily have led to the formation of Gothic architecture, such as we now find it.

These few generalizations will serve as a mere sketch, and help us to point out the affinities between the preceding style and the two other branches of the same stock, the Saxon and Norman. In regard to these, it is doubtful whether any authenticated examples of the first-mentioned remain, it being now generally suspected that what has been called Saxon is no other than early Norman, before that style had expanded itself by being employed on a larger scale and with greater refinement of design. Such may be the case, yet there is every reason to suppose that the early Norman itself differed from the genuine Saxon only in degree, and not at all in kind. Undoubtedly the architects of the Saxon period copied the mode of building then prevalent in Italy, and which we have just described, although they were unable to vie with their models. We may therefore be allowed to infer the character of Saxon architecture from that of the specimens which have hitherto passed current for it; and to conclude that it was stamped

by rudeness and massiveness. From the accounts left of Anglo-Saxon buildings by chroniclers great deductions ought to be made in regard to the commendations they have bestowed upon them; yet, as far as anything can be made out from such exceedingly vague and scanty notices, they do not appear to contradict the opinion we have assumed. Architecture, and the arts connected with it, must have sadly retrograded if the structures spoken of by contemporary writers as magnificent deserved to be so termed, even in a qualified sense, when those supposed to have been erected about the time of the Conquest are so uncouth even in what scanty embellishment they possessed.

Norman, which was only a gradual expansion, or perhaps we should say, sudden expansion and gradual refinement, of the Anglo-Saxon mode, possesses so many indicial marks in common with the Lombardic, that we are warranted in regarding it as merely another branch of the Romanesque. Here likewise arches exhibit themselves in profusion on the exterior of buildings, and, as on the west front of Lincoln, at Castle Acre Priory, Norfolk, &c., present the appearance of tiers of galleries; but, as frequently as not, with this difference—that each arch passes over the next column to the one beyond it, so that the arches in the whole range cross and interlace each other, and by their intersections cause the space between every two columns to become an acutely pointed arch, similar to those first brought into use, and constituting the lancet-arch style. Should this explanation not be sufficiently intelligible, the reader will refer to the first cut, which also offers an example of arches according to the general Lombardic mode. As in this last-mentioned style, so too in Norman, the windows are round-headed, and, except in some very large buildings, of small dimensions, being merely a simple aperture undivided by mullions, though instances are not uncommon of two arched openings being put together with a central pillar between them, as shown in the annexed specimen from Caston church, Northamptonshire.

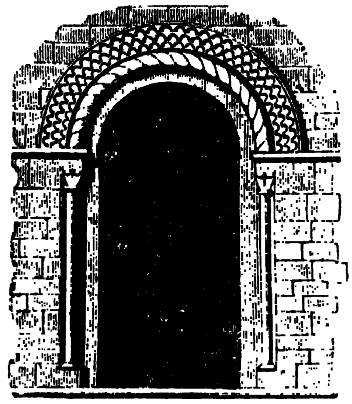


Window, Caston Church

And here we may observe, that this mode of including two or more distinct arched openings divided by columns, within a larger arch, occurs in many Italian buildings; among others, Or San Michele, Florence (1337), and the windows of the palazzo Strozzi, in the same city, which edifice bears, in regard to them, a marked resemblance to the Norman mode of composition, although it was not commenced until 1491.

Windows of a precisely similar description occur in the singular church of St. Stefano Rotondo, at Rome, supposed by some to have been originally a temple dedicated to Faunus, by others a market; and which, besides other peculiarities, exhibits two orders of different heights, and plain arches resting immediately upon the capitals of Corinthian columns. There can be no doubt that it belongs to the period of the *Décadence*, when that loftiness of interior began to be aimed at, which is so contrary to the proportions observed in the Pantheon, but which has ever been affected by Italian architects within buildings covered by a dome.

Another window, from Southwell Minster, Notts, shows a somewhat different mode of inserting the columns into the window recess, and cutting them, as it were, out of the jambs. Windows bearing a strong similarity to this example occur in Lombardic buildings; as those in the tower of St. Abbondio, at Como, where however the outer mouldings of the arch do not rest upon impost lines,



Window, Southwell Minster.

but are carried down to the bottom, forming a broad enriched border along its sides. Doorways partake of the same forms and decorations upon a larger scale, and carried to a greater extent, the arches being cut into variously carved mouldings (among which the chevron, or zigzag one, is the most usual), and the number of columns at the sides is increased. The one here represented is from Romsey Abbey, Hants, and will serve to give a general idea of the

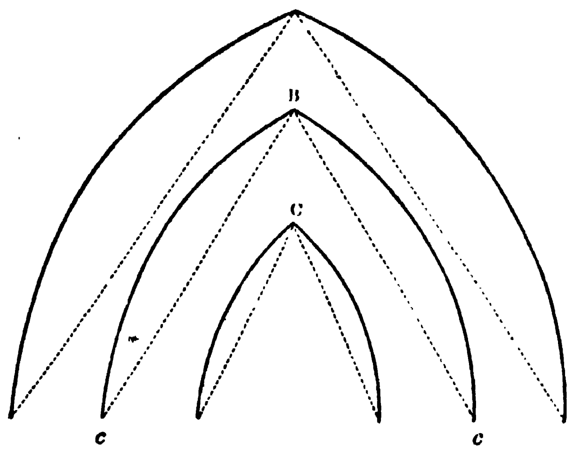
Doorway, Romsey Abbey.

character of such entrances, setting aside what relates to mere detail. There is also an obvious resemblance in regard to proportions, the smaller doorways in both styles being taller in comparison with their width than the larger ones, which, measured across the external mouldings, seldom vary much from a square and a quarter to a square and a half in height. In Norman doorways again the aperture is frequently, though not so invariably as in the other style, made square-headed; and the head of the arch is sometimes filled with sculpture, sometimes left quite plain. If we look for further points of resemblance we shall find them in the plain parapet, corbelled upon either small pendent arches or modillion blocks, somewhat after the fashion of machicolations (a very expressive name, its literal meaning being *mèches couler*, i.e. to pour down matches and other ignited materials on besiegers, for which purpose apertures were left between the blocks, or corbels); and also in the vertical projections like very shallow buttresses, which were frequently made to break at intervals the exterior of walls. In the interior of churches the open arches are generally turned on exceedingly massive cylindrical piers—for pillars they can hardly be called. This is particularly the case in crypts and other subterraneous constructions, where such pillars scarcely exceed three diameters in height, and sometimes fall short of that proportion, yet look less heavy than those in the nave, or other parts aboveground, owing to their being so much wider apart, and the arches they sup-

port being, in comparison with them, so much more lofty. Norman pillars of the kind above alluded to are sometimes quite plain, but frequently also ornamented on their surface with various mouldings, such as the chevron, or zigzag, in horizontal rings; or reticulated with raised intersecting stipes, or else channelled vertically or spirally; while others consist of lesser columns attached to the main one. Of Norman work various specimens occur in most of our English cathedrals, as will be seen by referring to the article CHURCH, which contains some particulars respecting them. Waltham Abbey, and St. Bartholomew's, West Smithfield, are also interesting examples of Anglo-Norman.

The transition from the Norman to the Pointed style was somewhat sudden and abrupt, the latter being adopted at once for the carrying on and completion of buildings that had been commenced according to the first; and in course of time similar changes in the mode of building took place, as fresh improvements were ingrafted upon that which had previously been followed. It is owing to this practice, and to the sudden abandonment of one system of design for another, that most of our larger Gothic buildings offer so many successive varieties of architecture, and that we are enabled to determine with tolerable accuracy the dates of the respective portions, and the time of commencement and duration of different styles: for the architects of those ages seem never to have reverted to a style which had been generally discontinued, or to have endeavoured to revive what had once been exploded. With them design appears to have been experimental, inventive, and innovating, throughout its successive stages: whereas modern design is nearly entirely retrospective, and imitative of some one previous mode adopted as a model, accordingly as the taste of the architect or his employer may suggest.

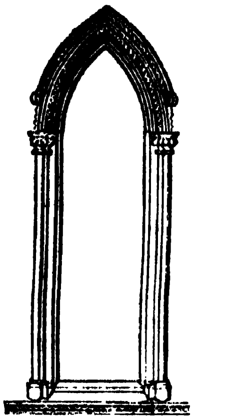
Of the Pointed style, at which we are now arrived, and which we can do no more than consider with reference to our own country, several distinct classes or phases have been established, differently named by different writers. Dallaway divides them into five, viz. Semi or Mixed Norman, from 1170 to 1220; Lancet-arched Gothic, from 1220 to 1300; Pure Gothic, from 1300 to 1400; Ornamented Gothic, from 1400 to 1460; and Florid Gothic, from 1460 to the extinction of the style, in the middle of the following century. Rickman, on the other hand, reduces the classes to three: Early English, from the end of the reign of Henry II. to the end of that of Edward I., or from 1189 to 1307; Decorated English, from 1307 to 1377, or a few years later; and Perpendicular English, from 1377 to the close. Thus we find that under the term Perpendicular he comprises both the Ornamented and the Florid Gothic of the other as essentially belonging to one and the same class, namely, that which is marked by the prevalence of perpendicular lines, both in the tracery of windows and in other decoration. The term itself has been objected to by many, but it must certainly be allowed to be a tolerably intelligible and descriptive one, and so is that of Florid Gothic; but the latter is not so appropriate to the entire class comprehended under it as to particular examples of it, such as King's College Chapel, Cambridge; Henry VII.'s Chapel, Westminster; and St. George's, Windsor, where the whole surface of the building is enriched; for it not unfrequently happens that particular features, doors and windows, &c., are of elaborate and rich design, and yet, taken as a whole, the building may be rather plain than otherwise. So too there are specimens in other styles, which, both from the minutiæ and profusion of detail, might very well claim to be characterized as Florid. Were it not that there are so many other and collateral particulars, all more or less characteristic and influential, it would not be difficult to form a scheme of classification for Gothic architecture analogous to that observed for Grecian, taking the arch as the indicial characteristic of each family or tribe, and describing it accordingly as belonging to the acute arch, the equilateral, the drop, and the compound or four-centred arch respectively. Here it may not be improper to explain the different kinds of pointed arch, which are such that the style named from it contains in that respect, owing to its being struck from two centres, a source of variety unknown to any other; for the single-centred, or round-headed one, can be varied only by making it more or less than an exact semicircle, in which former case it approaches the horse-shoe curve, and in the latter becomes a segmental or scheme-arch. But arches struck from two centres, and therefore pointed by the two curves meeting each other, may be of various degrees of acuteness, and exhibit great differences as to the proportion which the chord or span of the arch bears to a vertical line drawn from it to the vertex or crown. In the semicircular or one-centred arch the span is invariably equal to double the radius, or line drawn from the centre to the intrados, or curve bounding the aperture; but in the narrow acute lancet-arch, which is extra-centred (that is, is struck from centres on the outside of the arch), the span is less than the radius, and the arch itself consequently narrow and tall, and more or less so in proportion as the distance between the centres is increased or diminished. In the equilateral arch, sometimes distinguished as that characteristic of Pure Gothic, the centres coincide with the extremities of the span, which is equal to the radius, so that the chord and the two lines drawn from the centres to the vertex form an equilateral triangle. This species of arch is called by the Italians the *sesto acuto*, because the lines just mentioned are equal to the radius, or one side of a hexagon described within a circle struck by it. When the radius is less than the span, or, in other words, the centres are on the span itself, the arch becomes a *drop*, or, more correctly speaking, an obtuse-pointed one, the other term being more suitable for such as have their centres below their span or impost line; and it is hardly necessary to observe that the arch becomes more obtuse in proportion as the centres are brought nearer each other, for were they to unite the arch would become a single-centred and semicircular one. All these varieties may occur in the same example; because if the mouldings be very numerous, and occupy a great space, as is frequently the case in doorways, being all concentric, some of the curves will describe inner centred or obtuse, others extra-centred or acute arches, as may be perceived by this diagram, which, omitting the intermediate mouldings, will serve to exemplify the several varieties of the two-centred arch above defined.



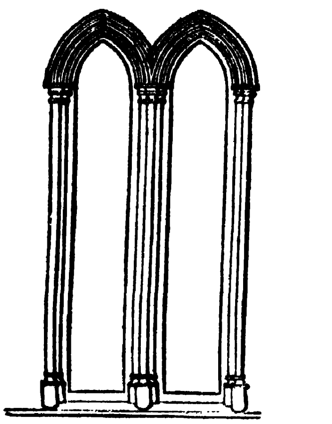
The centres in the intermediate figure (B) being at *c c* respectively, and the line joining *c c* being also the chord or span, B is an equilateral arch: A and C are respectively obtuse and acute arches, the centres in the arch A being on the span, and in C being without it, as above explained. The four-centred arch, so prevalent in our later or Perpendicular Gothic as to be almost characteristic of it, is, on the contrary, struck from two centres on each side, one on the span of the arch, and the other below it, as will afterwards be explained.

Having given these necessary explanations, we proceed at once to the broader distinctions of the three subordinate styles into which our Pointed architecture has been divided, without attending to the intermixture produced by the transition from one to another of them. The first style, denominated by Rickman Early English, and answering to the Pure Gothic of Dallaway, was not completely developed until a full century or more after the perfect pointed arch had been applied in the church of St. Cross, near Winchester, erected by Henry II. in 1132, about fifty years earlier than the period from which the commencement of the style itself is usually dated. At first the arch was exceedingly acute, and employed chiefly where small span was required, as in windows, which at first consisted of a single aperture, then of two, either distinct, with a narrow space or pier between them, or combined together by means of a central pillar. This led to similar grouping of three apertures, the

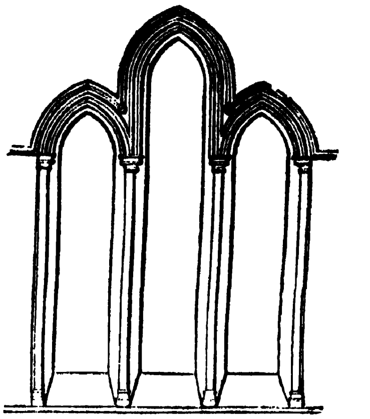
centre one of which rose higher than the others, and also to the practice of enclosing them within a larger arch, the space between which and the lesser ones was filled up with a circular one, whereby the whole acquired not only greater variety, but that architectural distinctness and completeness of form in which the earlier kind of double-window was deficient on account of its outline sinking instead of rising in the centre, and it looking merely like two arches belonging to an extensive range. These gradations in the compositions will be clearly understood from the subjoined



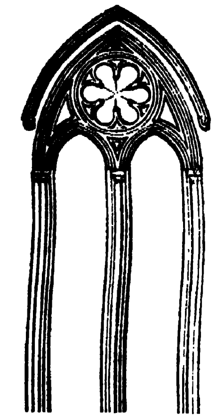
York.



Winchester.



York.



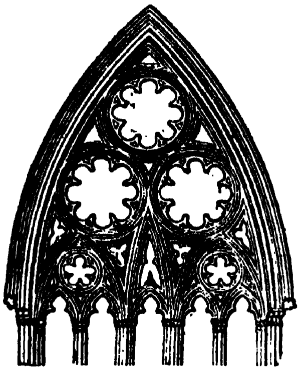
Westminster.

figures, the first and third of which are specimens from York Cathedral, the second from Winchester, and the fourth from Westminster Abbey: the mode shown in the last evidently led the way to that of decorating the window-head by dividing it into smaller and more varied compartments of ornamental panelling, which, whether perforated or not, is known by the general term of tracery, and constitutes a species of embellishment predominating in all the varieties of the Pointed style, and likewise in all the different national schools of it.

In the first class of our own Pointed, or our Early English, the openings of the windows are lancet-headed, and not only narrow but tall; that is, the part below the spring of the arch is very long in proportion to its width, a circumstance totally independent of the form of the arch itself, and therefore affording all the greater scope for variety. In fact, we behold a striking difference in respect to proportions exemplified in the doorways of the same period, for although similar as to general character, and frequently, like the later double-window above represented, consisting of two arches divided by a central pillar, either single or clustered, with a circular compartment above them in the larger arch-head, the height from the ground to the springing of the arch is sometimes even much less than the width of the whole design, and not much more than double that of the smaller arches. The receding sides, or splays, of such doorways were as deep as those in the Norman style, and enriched with columns; and the dripstone, or hood moulding, (for it is variously termed, and is the only moulding projecting from the wall, as all the others receded within its surface) not unfrequently rested upon carved heads. Instead of being placed upon pillars or cylindric piers, as in the Norman style, the pier-arches (so called in order to distinguish them from arches introduced in walls), which are mostly lancet ones, are placed upon piers with shafts attached to them, so as to give the whole a clustering form; but there is so much variety, both as to plan and the enrichment of capitals and other details, as to render it impossible to enter into particulars without explanatory drawings from different examples. The buttresses have greater projection than the parts which appear to answer to them in Norman architecture. They are also narrower, and some of them are divided into two or more stages by set-offs, or horizontal splays, reducing the projection from the wall at every stage. Buttresses of this kind have generally a triangular head or small gable at their summit. Salisbury Cathedral, which was begun in 1217, and finished in 1280, is not only a remarkably fine specimen of this style, but the most complete, being of nearly uniform character throughout. Lincoln and Westminster Abbey also furnish some admirable examples of it; and the Lady Chapel of St. Saviour's, Southwark (now restored), which belongs to this period, exhibits at its east end four compartments, with triple lancet windows, and smaller ones of the same kind above them. Germany possesses a very interesting and beautiful specimen of the same style and period in the church of St. Elizabeth at Marburg, contemporary with Salisbury, which it resembles in regularity of design, having been erected between the years 1235 and 1283. It is fully described by Moller in his work on German-Gothic architecture, where it is illustrated by eighteen plates; and an elevation of its west front forms the frontispiece to the translation of Moller's text by Mr. W. H. Leeds.

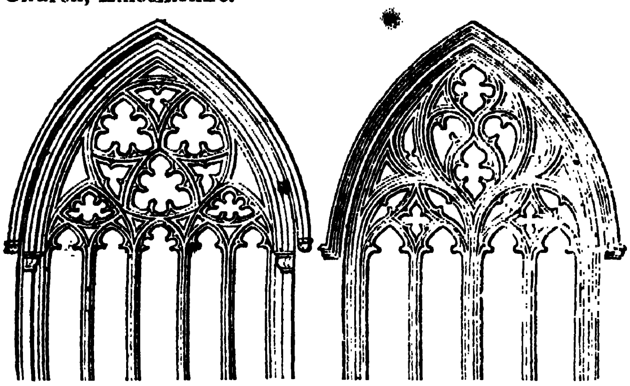
We now arrive at the second class of our English Gothic, which prevailed nearly an entire century, or the whole of the fourteenth. In regard to this a recent author, Mr. Archibald M'Lellan, observes, in his 'Essay on the Cathedral Church of Glasgow,' 'The most perfect state of Gothic architecture existed from the middle of the thirteenth to the beginning of the fifteenth century. Its characteristics are, the finely-formed arch, included within an equilateral triangle; the clustered column, and better proportioned than heretofore; the mullions of the windows ramifying into rich tracery, arising out of intersecting and reversed curves, assuming the form of flowers and leaves, and which has received the name of the decorated style of window; in others the mullions were perpendicular, but broken into compartments by horizontal bars called transoms, the divisions increasing in number as they ascend, until the space within the arch becomes as rich in decoration as the window just described. This style is denominated the Perpendicular.' Having in this quotation somewhat anticipated in regard to the last-mentioned style, we may as well take this opportunity to observe that the writer is one of those who object to Rickman's nomenclature, which he says appears to him 'to be more fanciful than descriptive of the three great divisions of our architecture; and that while th terms Decorated and Perpendicular are perfectly appropri ate when applied to windows, they ought not to be assumed as representing a whole æra, none of the different styles being so sharply defined as each to stand clearly out from its predecessor; but on the contrary we see them struggling during many years, as the taste of architects wavered between them: yet, taking the curve of the arch to be the leading characteristic, the grand features are sufficiently distinct in all.' To which he adds, shortly after, 'That splendid part of Winchester Cathedral built by William of Wykeham in 1394, though altogether in the Perpendicular style, is as chaste and magnificent as any Gothic of a prior date.'

In resuming our observations on this second stage of the Gothic, we must as heretofore confine ourselves chiefly to the arch and the features composed of it, such as windows and doorways. Of windows a no less instructive than beautiful transition specimen is afforded by those of York Chapter-house, where we distinctly behold the progress to more complex geometrical tracery. The arch of the window is still of the lancet form, and highly pointed, being extra-centred about two-thirds of its span; and the increased degree of enrichment is produced, not by the introduction of new elements, but by repeating and combining those previously in use. Thus the foliated or cusped circle (which probably gave origin to the round windows known by the name of wheel or marigold windows, the cusps being prolonged so as to form spokes) continued to be the chief member decorating the head of the window, being merely tripled



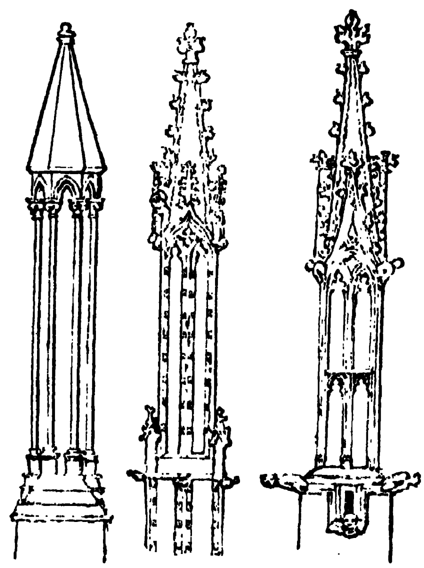
From York Chapter-house.

in number, an arrangement which accords beautifully with the triangular outline of the space so occupied; at the same time that these circular divisions contrast agreeably with the acute form of the arch, and soften its asperity. In like manner the multiplied divisions in the lower part of the window are produced by merely putting together two arched compartments with circles in their heads, similar to the example already given from Westminster, with a narrower one between them; thus forming the whole lower space into five narrow compartments, each of which has its own arch. In these lesser arches, which are simply cusped, and so far differ from those in the first example, we see the commencement of trefoil and cinquefoil ones; while in their shafts we plainly recognise mullions, which were afterwards of general application, either of uniform dimensions, or, in larger windows, consisting of principal and secondary ones. When the arch became equilateral, or nearly so, the tracery also assumed a different character, becoming of that kind which is called geometrical, and consisting of more varied forms and patterns, produced by circles, portions of circles, and other curves, enriched with cusps, dividing the spaces into foils. Of such windows we give examples from one at Exeter, and another at Kirton Church, Lincolnshire.



In the first of these the pattern is formed chiefly by a single large circle subdivided into three spherical triangles sixfoiled, and three lesser ones trefoiled; to which minutiæ we call attention in order that the reader may be led to examine the figure attentively, and thereby learn, without further explanation, what is meant by those terms, and by *foils* and *cusps* generally. He will here further observe that small shafts and capitals have given way to mullions, although retained at the sides of the window. The other example differs from the one just spoken of, not only in its tracery, which is more playful and flowing, but in having two orders of mullions, that in the centre, or the principal mullion, being thicker, and composed of more mouldings than the secondary ones. It deserves also to be remarked that here the number of the open spaces, or lights, as they are termed, is even, and that of the mullions uneven; whereas in the other and the preceding figure the lights are uneven, and the mullions even in number; a circumstance quite independent of style, since either mode is followed accordingly as it best suits the design for and principal divisions of the window-head. Of what is called geometrical tracery numerous specimens occur in the rich west front of York Cathedral, finished about 1330.

As mullions began to be substituted for pillars or shafts in windows, so too, both in the splays of doorways and in arch piers, columns began to be incorporated with the main pier, or splay itself; and in smaller doorways the arch mouldings are frequently continued down vertically, without any indication of capital, or impost to the arches, and die away, as it is termed, into a sloping surface, at a short distance from the ground. The external projecting mouldings of the arch, called by some hood-mouldings, by others weather-mouldings, or dripstone, as serving to throw off the droppings of rain, usually rest on corbels cut into the forms of heads. In many instances these hood-mouldings, both of doors and windows, are surmounted by other mouldings, forming a kind of gable, distinguished by the name of canopy. These canopies are generally enriched with crockets, small leaf-like ornaments, placed at intervals on the outer edge; and the pediment heads to the different stages of buttresses are often similarly decorated. In conformity with the rest, greater ornament was likewise bestowed upon pinnacles, as will be seen on comparing an early English specimen of such feature, from Wells Cathedral, with two others belonging to the second style, the first from St. Mary's, Oxford, the other from York.



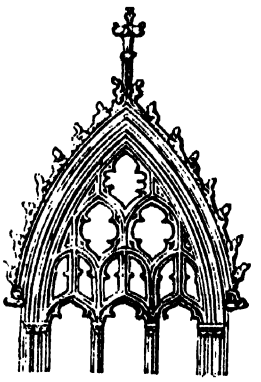
In regard to the general character and design of ornament, that which consists of foliage is generally richer, drawn with greater freedom, and more natural. So too in the groined vaulting of roofs additional variety and richness were produced by the addition of intermediate ribs intersecting each other, so as to produce a kind of tracery consisting of stars and other figures. By way of instancing one or two of the finest examples of Decorated English, we may mention the choir of Lincoln (1324), the nave of York (completed in 1330), St. Stephen's Chapel, Westminster (begun in the same year), parts of the choir at Lichfield, &c., and, as a finished specimen of general composition, the west front of York, which, in regard to its outline and leading parts, has been imitated on a small scale in that of the Scotch church, Regent-square, London.

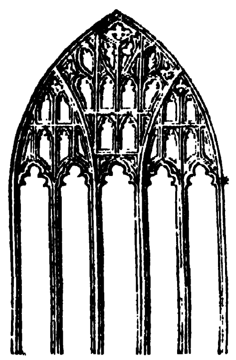
Before we take leave of this division of our subject, it may not be amiss to observe that instances of acute-pointed arches are by no means unfrequent, yet without any of the character of the lancet-arch style, such arches being filled with tracery, and in their general design similar to others. In many cases the reason for applying them is obvious enough, as they occur in narrow compartments and windows, where it has been thought better to vary the form rather than not keep all the arches of the same height. Neither is it uncommon to meet with the acute or extra-centred arch in the subordinate divisions of windows whose heads are much lower than an equilateral arch, owing to the arrangement of the compartments, as in the great west window at Winchester. So also are there examples of Norman and other round-headed arches having been subsequently filled up with tracery of a late date, as one in the south transept at Norwich; nor are similar combinations unfrequent in Italian buildings, in evidence of which we may cite Or San Michele, at Florence, and the cloister of the Campo Santo, at Pisa.

Having now reached the third class of the Pointed style,

which may for convenience' sake be dated from 1400, and considered that of the fifteenth century and part of the following one, we must remark, that although the name Perpendicular, first bestowed on it by Rickman, and now adopted by many others, appears to be tolerably correct in some respects, it is rather objectionable in others; because, if 'the mullions of windows and the ornamental panellings run in perpendicular lines,' it is no less obvious that the numerous transoms, square-headed labels to doorways, and ornamental string-courses and cornices, produce as many horizontal ones; consequently Horizontal would be an equally appropriate term; and perhaps the more appropriate of the two, since the mullions thus crossed by transoms do not exhibit that prevalence of perpendicular lines, which mullions alone, or slender columns do. The same may be said in regard to labelled doorways, &c., where the pointed character produced by the arch in a great measure loses itself, and is exchanged for that marked by squareness of outline. Nay, the very form of the arch itself shows a tendency to horizontality, by becoming so flattened that the height is sometimes less than one-fourth of the span (whereas in the equilateral arch it exceeds that measure). In offering these remarks, we have no ambition to bring forward a new term of our own, with the view of its being adopted: neither would we be understood as considering this third style to be decidedly inferior to the other two. On the contrary, it is the one to which, were we unfortunately called upon to make an exclusive election, we should give the preference, if merely as being upon the whole better accommodated for general application and a variety of purposes, for domestic as well as ecclesiastical buildings.

In order to exhibit the progress towards this style, we give two transition specimens of windows from York choir, the first decidedly of a transition character.



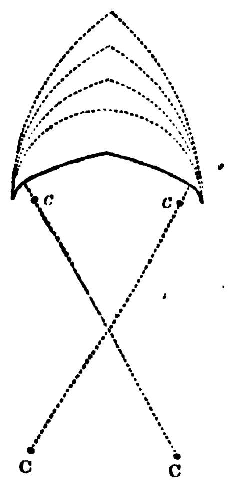


In both the arches of the windows are those of the preceding styles, in the first being extra-centred, in the second equilateral. But the tracery here begins to assume some of that compactness and squareness which is so characteristic of the after-period. Upright lines or shorter mullions are introduced into the window-head, some in continuation of those below, others rising from the points of the arches which form the heads of the lower compartments; so that if we wished to express this circumstance by a single term, we might employ the epithet *super-mullioned*, as indicating that the upper divisions of the windows have mullions rising from the arches of the lower ones. These two examples will further be useful, the first as supplying an example of *crockets* on the outer arch-moulding, and of a *finial* on its apex; the other as an instance in point as respects what we have said of very acute arches being included in the tracery to windows whose arches are equilateral, or even much lower; for those which form the heads of the two compartments, each comprising two lights on either side of the centre one, are highly pointed, being extra-centred, and their height equal to $1\frac{3}{5}$ their span.

We offer no apology for thus detaining the reader by dwelling upon particulars comparatively unimportant, while we pass over so very much that is essential to be known. Want of space precludes us from entering into anything like a full and systematic view of so exceedingly extensive a subject; yet although we are obliged to take a very limited view, there is no occasion to render it a very superficial one also. We do not profess to teach much, but we are anxious to teach so that the learner shall be made to feel at once the interest of the study, to perceive how it ought to be followed up, and how he may best turn to account the information which he may afterwards obtain from works which treat of it more copiously.

Confining ourselves, as before, chiefly to windows, doorways, and arches, we now resume. As one grand criterion of this style, wherein it differs so materially from both those which preceded it, and, in the opinion of some, so very disadvantageously that they have not scrupled to date from it the declension of the art itself, its ultimate degradation and loss of all character, we ought perhaps to speak of the arch in the first place. Our last cut exhibits this third style only in regard to the general mode of designing tracery in it, the window-arch being an equilateral one, and consequently struck from only two centres; whereas the style cannot be said to manifest itself unequivocally until the compound or four-centred arch made its appearance. Of this kind of arch, which we believe to be almost peculiar to England, we are unable to say what was the very first instance, or what led to its adoption; for so intent have our antiquaries been upon ascertaining the origin of the Pointed arch, that no one has thought of inquiring into that of the Depressed one, whose more studied and complex form renders it far less likely to have suggested itself than the other.

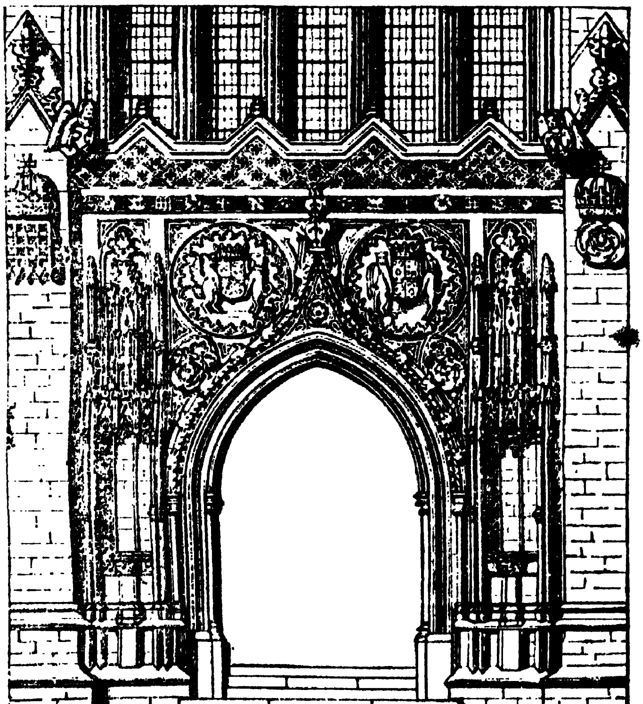
Having thus opened a fresh field of inquiry, all we shall say on the matter is, that such curvatures were probably derived, in the first instance, from some of those occurring in tracery, although we are aware that such origin is little in accordance with architectural principles, since rarely, if ever, do we find that the subordinate parts and members of detail have influenced the leading forms, but, on the contrary, have always been influenced by them: or it may have arisen from the attempt, after the two-centred arch had been gradually dropped more and more, to obtain a pointed arch even lower than the semicircular one, which was probably done in the first instance by drawing the curves by hand of the desired pitch, and afterwards finding out the centres for the curves, and so establishing the geometrical mode of operation. By the annexed diagram it



will be seen that the superior centres, *c c*, for the shorter radii describing the two quadrants at the spring of the arch, are upon the span-line itself; and the two inferior centres, C C, whose radii are in continuation of the others, describe the remaining curves meeting at the vertex of the arch. This compound form admits of great diversity, according to the proportion the shorter and longer radii bear to each other, or in other words, according as the centres are fixed. In order to exhibit at the same time a comparison of this kind of arch both with the semicircular and the varieties of the two-centred one, we have enclosed it within dotted lines, representing the others in succession above it, by which it will be apparent that if the span be the same, the extra-centred or lancet arch will be the highest, next to that the other two-centred arches, then the semicircular one, and lastly the compound or four-centred arch. But if, on the contrary, they were all made equal in height, the order of precedency would then be reversed, for the four-centred one would be the widest, and the lancet the narrowest, as has already been partially exemplified in a preceding diagram.

That Mr. Rickman does not consider the compound arch as an essential ingredient of what he terms the Perpendicular English, is evident, because he dates that style from a period long before it was brought into use, which does

not appear to have been earlier than the middle of the fifteenth century; and this receives some confirmation from such arch having obtained the appellation of the *Tudor*. This third class of our English Gothic would readily admit therefore of being further subdivided, according as it is employed with two-centred, or compound arches, even though in other respects there may happen to be little difference of character. Its windows, as has been stated, were not only mullioned but transomed; and in some of the richer examples the transoms are *embattled*, or indented by being cut into small battlements. As to the variety they display in their tracery, it is quite impossible to describe it, since almost every specimen exhibits a different pattern; the general character of which may however be understood from the second of the examples above given from York Cathedral. On the other hand there are instances of compound-arch windows of exceedingly plain design, being without either tracery of any kind or transoms, as are those of the hall of the palace at Croydon, which is supposed to have been erected about the middle of the fifteenth century. Of doorways the outline became square, owing to the arch being inclosed within mouldings forming what is called a *label*, which generally terminated at the spring of the arch, where it either rested upon corbels in the form of shields or heads, or was else bent and returned horizontally for about double the breadth of the other mouldings. The triangular spaces or *spandrels* thus formed between the curved mouldings of the arch and the square ones of the label are mostly filled up with quatrefoil circles or other decoration. In the larger and richer kind of doorways, as in the porch of King's College Chapel, Cambridge, the spandrels are greatly enlarged by the head of the square panel or compartment in which the arch is placed being carried up much higher. In this example there is an ogee canopy formed by what are called mouldings of *contrary flexure:* and this is crocketed and surmounted by a finial. It should be remarked however that although



Doorway, King's College Chapel, Cambridge.

this specimen has been selected as a beautiful instance of the later or Perpendicular style, it does not exhibit the four-centred, or compound arch, notwithstanding that the latter characterizes the other parts of the edifice.—In the architraves or mouldings along the sides of doors and windows there are generally one or more large hollows, which may be taken as one of the marks of this style.

Although they have not labels, both windows and pier arches are not unfrequently treated somewhat similarly, being placed within square-headed compartments, whose spandrels are filled up with tracery resembling that of the window; which practice, no doubt, afterwards led to that of square-headed windows, by perforating the whole compartment, and makin the spandrels part of the window itself. Windows placed within compartments, with spandrels of blank tracery, may be seen in the *clerestory* (the upper range of windows in a church, admitting light into the nave and choir, above the arches of the aisles and the *triforia*, or galleries over them) of Henry VII.'s Chapel.

Hitherto we have spoken chiefly of arches and windows, but we must now briefly advert to the roof, at least to one species of vaulting used for it, peculiar to the florid class of this style, we mean that consisting of *fan-tracery*, so called from the numerous small ribs or mouldings spreading out from the spring of the groining as from a stem, and radiating so as to describe a semicircle, the fan on one side meeting that on the other, in the centre of the vaulting; whereby a spandrel with four convex curves for its sides is left between two opposite pairs, and this space is either filled with tracery arranged so as to form a circle, or else is occupied by what is called a *fan-pendent*, similar to the other fans, except that its base on the ceiling is an entire circle instead of a semicircle. Of fan-groining with enriched spandrels only, the cloisters of St. Stephen's Chapel, Westminster, offered a beautiful example; and of that with pendents, the chapels of King's College, Cambridge, and Henry VII., Westminster. The two structures just mentioned and St. George's Chapel, Windsor, are in every respect perfect examples of this style, being of uniform design throughout, without intermixture of any other. Mr. Hosking, who calls it the Corinthian order of Pointed Architecture, observes that it is almost peculiar to this country, and that neither Germany nor France can show any buildings similar to those above instanced. Mr. Willis, too, whose recent 'Remarks on the Architecture of the Middle Ages' contain much entirely fresh and important information, says, 'the Perpendicular is our own, and heartily may we congratulate ourselves upon it when we compare it with its sister styles in France and Germany.'

As we have already hinted, this third, or *later English* style, should such term be preferred to Mr. Rickman's, may be subdivided into two classes, as regards decoration, independently of date, namely, Simple and Florid; or else into two periods, the one prior, the other subsequent, to the middle of the fifteenth century; as has been done by Mr. Lamb in his 'Observations on the Classification and Details of the Architecture of the Middle Ages,' (*Archt. Mag.*, No. 20) to which we would refer the student, not only on account of the subject being very intelligently treated, but illustrated by a great many figures.

This third class of the Pointed style, or that which prevailed during the whole of the fifteenth and the first half of the sixteenth century, is greatly more extended, both in its uses and modifications, than the other two, having been applied to domestic as well as ecclesiastical architecture: whereas we are acquainted with the preceding styles only as it was employed in religious buildings; for castellated ones of the same periods have so little in common with the former, and so very few features wherein the general style at all exhibits itself, that they must be considered as forming a distinct class by themselves. In the ornamented domestic architecture of the fifteenth and sixteenth centuries, generally designated Tudor, as there are few examples before that period, we plainly perceive the same style as that of ecclesiastical buildings applied to another class, where, although the parts are on a smaller scale and somewhat differently composed, the style of detail and ornament is essentially the same. While some features, such as doors and porches, are very little altered from those of churches, others unknown to the latter class of buildings, such as chimneys, become highly characteristic and decorative in this. Bay windows and Oriels are likewise peculiar to it. These terms are often used indiscriminately, but it is better to confine the first to such projections, filled in with windows, as rise immediately from the ground; and the second to similar projections when they jut out in the upper part of a building and overhang that below, being corbelled upon mouldings forming a splay tapering downwards on every side. Oriels are either single or compound, that is, are either confined to one of the upper floors of the building, or carried up through all its stories; of which latter description is the singularly rich one in the entrance tower of Magdalen College, Oxford, accurate drawings and details of which are given in Pugin's 'Gothic Examples,' a work containing many choice illustrations both of entire buildings and particular parts belonging to our domestic architecture of the Tudor period, including Thornbury Castle, Gloucestershire,

and East Basham House, Norfolk, both of them admirable for their respective beauties, and, not least, for their highly decorated chimney-shafts. In modern mansions professing to be in imitation of it, this style has rarely been applied either with success or consistency, very little of its spirit being transfused into them. The one in which it most displays itself is perhaps Cossey Hall in Norfolk, the seat of Lord Stafford, which was begun to be rebuilt upon an enlarged scale some years back, but is not yet completed.

Even as a mere sketch of the subject what we have said upon Gothic architecture is exceedingly deficient, because we have been under the necessity of confining ourselves to such parts of buildings as are mainly connected with the arch, whose various modifications constitute, if not invariably the chief, the most obvious distinctions between one style and another. Of towers, spires, lanterns, turrets, pinnacles, buttresses, and flying buttresses,—of the various forms of gables,—and also of embattled parapets, we have said nothing; neither have we once spoken of chapels and chantries, shrines and screens, chapter-houses and cloisters, and many other things of the kind, any single one of which would afford matter for a longer article than the whole of the present one. Our silence must extend also to composition and plan, in respect of both of which Pointed Architecture offers hardly less variety than it does in its details and ornaments, the combinations it admits being inexhaustible; whereas in Greek temples we meet with only one or two slight changes of the same idea. In this respect the difference between the two styles is palpable enough, but nowhere does it display itself so strikingly as within. Rarely indeed was the interior of a Greek temple more than a simple oblong apartment, so that a single view would suffice to convey a clear idea of the whole of it, and likewise of nearly every other; or, in fact, there is so little to show, that the appearance might be determined from the section alone. Of a Gothic cathedral, on the contrary, the interior would, in many cases, require at least fifty drawings from as many different points of view, in order to show it completely and so that no part should remain undescribed, nor any of its varied effects left to be conjectured from what is shown by sections. These latter again require to be much more numerous than they generally are, even in works which profess fully to describe a single structure; and besides these, there ought likewise to be several horizontal sections, or plans taken at different heights from the floor. The reader will hardly think that we at all exaggerate in what we have just said, if he refers to the article CHURCH, and after attentively examining the ground-plan of Durham cathedral, considers how very little of it could be shown in one or two general views where the parts in them would be rendered indistinct by foreshortening and distance, and if he considers also how many different stations a person must select in order to behold every part distinctly.

Those who censure the Gothic as an incoherent style, full of inconsistencies and caprices, as devoid of all harmony and proportions, and as a gloomy monkish mode of building, may be allowed to pique themselves on their fastidious classical taste, but certainly not on either their poetical sensibility or their philosophical discrimination. That both its proportions and its principles are widely different from those of Grecian architecture is self-evident; that the one are therefore incorrect, and the other deficient in harmony, is exceedingly easy to be asserted, yet exceedingly difficult to be demonstrated. So very far indeed is the Gothic style from being altogether arbitrary and inconsistent, that no one can give it attention with an unprejudiced mind without perceiving what consummate skill and beautiful intention of purpose, what invention, guided by true artistlike feeling, are to be distinctly traced throughout. So far it may lay claim to the greatest consistency. The mixture of different styles in the same edifice is a mere casual circumstance, not in the least detracting from the coherence and consistency of any one style taken by itself. Yet is not Salisbury Cathedral nearly uniform throughout as to style, and King's College Chapel completely so? Another error very frequently entertained is that, however suitable for buildings upon a large scale, the Gothic style is but ill adapted to small ones. Undoubtedly its most astonishing effects and displays of grandeur must be in spacious edifices; yet that it possesses also many delicate beauties and graceful forms capable of being fully displayed in smaller works, will be disputed by none who have ever entered some of our Gothic chantries and small chapels, or have seen, if only in a drawing, the beautiful little cloister of St. Stephen's Chapel.

By way of conclusion we now sum up a few of the more prominent distinctions between Grecian and Gothic architecture, as regards the application of their respective elements. *Grecian:* Columns and their entablature are the chief sources of decoration, and limit the height of the building, as a second order cannot with propriety be placed above another. *Gothic:* Columns subordinate members; never used except to support arches, and in the latter styles are mere ornamental shafts attached to piers. *Grecian:* Colonnades seldom employed except externally. *Gothic:* Ranges of open arches applied only internally; there being nothing analogous to a Grecian portico, since porches have merely an open arch in front, and when projecting from the building, are closed at the sides. Externally, open arcades are introduced only as upper galleries, and those are of very rare occurrence; or, as a cloister, not projecting from but within the lower part of the building. *Grecian:* Lofty proportions unattainable even in the largest edifices, because the greater the number of columns the lower will the building appear in comparison with its length or breadth. *Gothic:* No restraint as to loftiness, that not being regulated by width either of the whole front or any of its parts. *Grecian:* The pitch of a pediment must be governed by its span, since its height must in no case greatly exceed the depth of the entablature, consequently the greater the number of columns placed beneath it, the lower it must be, and the lower the proportions of the whole front. *Gothic:* Gables may be of any pitch, just as best accords with construction or the composition of the design. *Grecian:* Little variety of form and proportions in doors or windows, or in regard to their external mouldings; the window itself a mere aperture, without any architectural filling up. *Gothic:* Both doorways and windows very conspicuous features, admitting the utmost diversity, as well in their forms and proportions as in the modes of decorating them. Windows especially admit of innumerable combinations in regard to their divisions and the ornamental tracery within their arched heads. The same remark applies to the panelling of doors. *Grecian:* All mouldings and other decorative members project from the face of the wall. *Gothic:* All but what are termed weather-mouldings retire within the face of the wall. *Grecian:* No splayed surfaces. *Gothic:* Sloping or splayed surfaces, both horizontal and vertical, very prevalent; in fact windows and doors are universally placed within splays, more or less deep, and enriched with various mouldings. *Grecian:* No concave mouldings or deep hollows. *Gothic:* Deep hollows of this kind enter into almost every combination of mouldings, whether horizontal or perpendicular.

GOTHIC LANGUAGE. It is now generally admitted that the Gothic language or languages is or are a branch of the Teutonic family. (J. Grimm, *Deutsche Grammatik*, and H. Meidinger, *Vergleichendes Etymologisches Wörterbuch der Gothisch-Teutonisch Mundarten; Altgotisch, Althochdeutsch, Angelsächsisch, Altsächsisch, Altnordisch oder Islandisch, Neuschwedish, Neudänisch, Neuniederländisch, Neuenglisch, Neuhochdeutsch;* 8vo., Frankfort-on-the-Main, 1833.) The Altgotisch, or old Gothic, was the language of the Goths who lived near the banks of the Lower Danube in the 4th century, and for whom Ulphilas made a translation of the Gospels, of which the greater part exists in the silver book preserved in the library of Upsala. [ARGENTEUS CODEX.] Ulphilas was bishop of those Goths who lived in Mœsia in the time of the Emperor Valens, and the language of his version has been styled Mœso-Gothic. He is believed to have invented the characters employed in the version, and which are formed, with slight variations, from the Greek and Latin capitals. [ALPHABET.] Another branch of the Gothic or Gotho-Teutonic language existed in Scandinavia, which German philologists have called Altnordisch, or old Norse, and in which the 'Edda' is written, and which is still spoken with some variations in Iceland, the Faroe Islands and parts of Norway. (Meidinger.) Out of this language the modern Swedish, Danish, and Norwegian sprung. Inscriptions in the old Norse, or Scandinavian Gothic, have been found in several parts of Sweden, Denmark, and in the island of Gothland, in various characters different from those of Ulphilas's Mœso-Gothic versions. Bonaventura Vulcanius, the editor of Jornandes' *De rebus Geticis*, published also an anonymous treatise on the Gothic language; *Commentariolum Viri cujusdam docti*

anonymi in Literas Gothicas, with specimens of the Mæso-Gothic, old high German, Anglo-Saxon, and other old Teutonic dialects, followed by four different Scandinavian Gothic alphabets collected from various inscriptions, and one of which is similar to the one given by Magnus in his *Historia Gothorum Sueonumque*, b. i., ch. 7. The old Scandinavian, or Norse, or Suio-Gothic, is considered by Adelung as being a mixture of Gothic with the language of the Sveones, the original inhabitants of the Scandinavian peninsula previous to the Gothic immigration, and the modern Swedish, which is derived from the old Scandinavian, appears to have elements in it foreign to the Teutonic, though the Teutonic, or Gothic, greatly prevails in both. (Petersen, *Det Danske, Norske og Svenske Sprogs Historie*, Copenhagen, 2 vols. 8vo., 1830.)

GOTHOFRE'DUS. DENYS GODEFROY, born at Paris in 1549, studied at Louvain, Cologne, and other universities, and was made councillor of the Châtelet at Paris. Being obliged to leave France on account of the persecutions against the followers of the Reformed religion, which he professed, he went to Geneva, where he was made professor of law in 1580. In 1589 Henri IV. appointed him bailli, or governor of the district of Gex, bordering upon Geneva, but he was driven thence by the arms of the Duke of Savoy, on which occasion he lost his books and other property. In 1594 he was appointed to the chair of law at Strasburg, and in 1604 he removed to Heidelberg, where he filled the same professorship. In 1621, being driven from Heidelberg by the war in the Palatinate, he withdrew to Strasburg, where he died in the following year, with the reputation of being the first jurist of his age. His edition of the 'Corpus Juris Civilis,' 2 vols. fol., has often been reprinted; the notes are valuable. Among his numerous other works on law the following deserve mention:—1, 'Fontes Juris Canonici;' 2, 'Praxis Civilis ex Antiquis et Recentioribus Scriptoribus;' 3, 'Index Chronologicus Legum et Novellarum à Justiniano Imp. Compositarum;' 4, 'Quæstiones Politicæ ex Jure Communi et Historia absumptæ;' 5, 'Dissertatio de Nobilitate;' 6, 'Consuetudines Civitatum et Provinciarum Galliæ, cum Notis;' 7, 'Statuta Regni Galliæ, juxta Francorum et Burgundionum Consuetudines cum Jure Communi collata et Commentariis illustrata;' 8, a Greek and Latin edition of the 'Promptuarium Juris' of Harmenopulus. He wrote also on classical literature:—9, 'Notæ in Ciceronem;' 10, 'Conjecturæ, variæ Lectiones, et Loci Communes in Seneca;' 11, 'Auctores Linguæ Latinæ in unum redacti Corpus,' with notes; 12, 'Antiquæ Historiæ libri sex,' being a compilation from Berosus, Manetho, Cato, and other antient historians. He wrote likewise a controversial work on a subject of peculiar interest in his time: 'Maintenue et Défense des Empereurs, Rois, Princes, Etats, et Républiques, contre les Censures, Monitoires, et Excommunications des Papes.' His minor works, 'Opuscula,' were published together in one vol. fol. Sénebier, *Histoire Littéraire de Genève*, gives a catalogue of all the works of Denys Godefroy, with a biographical notice of the writer.

GOTHOFRE'DUS. JACQUES GODEFROY, son of Denys, was born at Geneva in 1587. In 1619 he was appointed professor of law at Geneva, and afterwards was made councillor of state; he also filled various other important offices of that republic, and was sent upon several foreign missions, all of which he discharged to the satisfaction of his countrymen. He was deeply versed in the study and history of jurisprudence in all its branches, was an accomplished classical scholar, and upon the whole was one of the most distinguished men that Geneva has produced. His principal work, about which he laboured for thirty years, and which was published after his death, is his edition of the Theodosian code, or collection of the Roman law as promulgated by Theodosius the younger, A.D. 438. This Theodosian code contains the edicts and rescripts of sixteen emperors, from the first Constantine to Theodosius himself; it is divided into sixteen books, and the laws are arranged in chronological order. An abridgment of this code is contained in the 'Breviarium' of Anianus, a compendium of the Roman law, compiled in 506, by order of Alaric, for the use of his Roman subjects. Several editions of the Theodosian code, all of them more or less defective, were published in the sixteenth century. The edition of Gothofredus, entitled 'Codex Theodosianus cum perpetuis Notis,' 6 vols. fol., 1665, is a master work of its kind. To the text of the Code Godefroy subjoins the antient explanation, followed by his own notes, in which he adverts to the various readings, and to the parallel or conflicting passages in the Theodosian and Justinian Codes; and he completes the illustration of each title by an ample commentary on the scope and tendency of the various enactments, presenting the reader with an immense mass of erudition, classical, historical, and juridical. He has moreover prefixed to the first volume a 'Chronologia Codicis Theodosiani,' followed by 'Prolegomena' on the same, concerning the history of the Code. The last volume contains 'Notitia Dignitatum seu Administrationum tam Civilium quam Militarium Imperii,' a 'Prosopographia,' or notice of all persons mentioned in the Code, a 'Topographia, sive Orbis Romanus ex Codice Theodosiano descriptus,' and a 'Glossarium Nomicum Codicis Theodosiani.' All these accessory tracts are so many mines of most valuable information. Gibbon, in the 'Memoirs of his own Life,' acknowledges the great obligations he owed to Godefroy's labours while composing his own 'History of the Roman Empire,' and he styles his edition of the Theodosian Code 'a full and capacious repository of the political state of the Empire in the fourth and fifth centuries.' About seventy years after the appearance of Godefroy's work, Professor J. D. Ritter republished it with various additions, in 7 vols. fol., Leipzig, 1736-45. Since that time inedited fragments of the Theodosian Code have been discovered in the Ambrosian and Turin libraries, filling up many lacunæ in the first five books. 'Codicis Theodosiani libri v. priores: recognovit, additamentis insignibus a W. F. Clossio et Amedeo Peyron repertis aliisque auxit, notis subitaneis tum criticis tum exegeticis instruxit Car. Frid. Christianus Wenck,' 8vo., Leipzig, 1825.

Among the numerous other works of Jacques Godefroy, the following are the most esteemed:—1, 'Manuale Juris;' 2, 'Fontes quatuor Juris Civilis, containing fragments of the Twelve Tables,' with notes; 3, 'De Statu Paganorum sub Imperatoribus Christianis;' 4, 'Opusculum de Imperio Maris et de Jure Naufragii colligendi, Lege Rhodia;' 5, 'Notæ in Tertulliani "Ad Nationes," libros duos ineditos;' 6, 'V. Orationes Libanii Sophistæ primum veste Latina donatæ;' 7, 'III. Orationes; de Statu Germaniæ, de Causa Odii Juliani in Christianos, de Causis Achæorum Reipublicæ Interitus;' 8, 'Dissertatio de Suburbicariis Regionibus et Ecclesiis;' 9, 'Fragmenta Legum Juliæ et Pappiæ collecta et Notis illustrata.' He also edited 'Philostorgii Cappadocis Ecclesiasticæ Historiæ, libri xii.,' and 'Vetus Orbis Descriptio Græci Scriptoris sub Constantio et Constante Imperatoribus,' in Greek and Latin. Godefroy wrote in French, 'Le Mercure Jesuitique, ou Recueil de Pieces concernant les Progrès des Jesuites depuis 1620.' Godefroy died at Geneva in 1652. His juridical works, except his illustrations of the Theodosian Code, were collected by Trotz, fol., Leyden, 1733, with a notice of the author. See also Sénebier, *Histoire Littéraire de Genève*.

GOTHS, GOTHI, a powerful northern nation who acted an important part in the overthrow of the Roman empire. The name 'Goths' appears first in history in the third century, and it was then used by the Roman writers as synonymous with the more antient one of Getæ, a people who lived on the banks of the Lower Danube, near the shores of the Euxine. The Greek writers generally considered the Getæ, or Goths, as a Scythian tribe. There has been much discussion on the question whether the Getæ, or Goths, came originally from Scandinavia, or migrated thither from Asia. The old Scandinavian tradition in the 'Edda' makes their chief Odin, or Wodan, come from the banks of the Dniester to the shores of the Baltic several centuries before our æra, though others fix this migration in the century previous to the birth of Christ. Some antiquarians have supposed that there were several Odins, as well as several migrations, at various epochs. However this may be with regard to the Scandinavian Goths, we find the Getæ mentioned in the time of Augustus as living on the banks of the Danube; and a century later, Tacitus (*German.*) mentions the Gothones inhabiting the shores of the Baltic as a German tribe, while he considers the Gothini, who lived in Southern Germany, as a tribe of Celts, or Gauls. About the middle of the third century the Goths are recorded to have crossed the Dniester and to have devastated Dacia and Thrace. The Emperor Decius lost his life in opposing them in Mœsia, A.D. 251, after which his successor, Gallus, induced them by money to withdraw again to their old dwellings on the Dniester. They then seem to have spread eastwards, and to have occupied the

country about the Cimmerian Bosporus, from whence they sailed across the Euxine, occupied Trebisond, and ravaged Bithynia. In the year 269 they landed in Macedonia, but were defeated by the Emperor Claudius II. Three years after, Aurelian gave up Dacia to a tribe of Goths, who are believed to be the Visigoths, or Western Goths, while those who ravaged Asia Minor were the Eastern Goths, or Ostrogoths. This distinction of the race into two grand divisions appears about this time. Under Constantine I. the Goths from Dacia invaded the Illyricum, but were repelled; afterwards Constantine II. allowed a part of them to settle in Mœsia, who seem to have soon after embraced Christianity, as it was for them that Ulphilas translated the Scriptures, about the middle of the fourth century, into the dialect called Mœso-Gothic. [GOTHIC LANGUAGE.] About the year 375, the Huns, coming from the east, fell upon the Ostrogoths, and drove them upon the Visigoths, who were living north of the Danube. The latter, being hard pressed, implored permission of the Roman commander to be allowed to cross that river, and take shelter on the territory of the empire. The Emperor Valens consented, and a vast multitude of them were allowed to settle in Mœsia; but soon afterwards they quarrelled with the Roman authorities, invaded Thrace, and defeated and killed Valens, who came to oppose them. From that time they exercised great influence over the Byzantine court, either as allies and mercenaries, or as formidable enemies. Towards the end of the fourth century, Alaric, being chosen king of the Visigoths, invaded North Italy, but was defeated by Stilicho near Verona. He came again however a few years after, and took and plundered Rome. His successor, Ataulphus, made peace with the Empire, and repaired to the south of Gaul, where the Visigoths founded a kingdom, from which they afterwards passed into Spain, where a Visigothic dynasty reigned for more than two centuries, till it was conquered by the Moors. Meantime the Ostrogoths, or Eastern Goths, who had settled in Pannonia after the destruction of the kingdom of the Huns, extended their dominion over Noricum, Rhætia, and the Illyricum; about the year 489 they invaded Italy under their king Theodoric, and defeated Odoacer, chief of the Heruli, who had assumed the title of king of Italy, a title which Theodoric then took for himself with the consent of the Eastern emperor. Theodoric was a great prince: his reign was a period of rest for Italy, and his wise administration did much towards healing the wounds of that country. But his successors degenerated, and the Gothic dominion over Italy lasted only till 554, when it was overthrown by Narses, the general of Justinian. From that time the Goths figure no longer as a power in the history of Western Europe, except in Spain. We find however their name perpetuated long after in Scandinavia, where a kingdom of Gothia existed till the twelfth century distinct from Sweden Proper, until both crowns were united on the head of Charles Swerkerson, A.D. 1161, who assumed the title of king of the Swedes and the Goths, which his successors bear to this day. [ERICK.] On the early history of the Goths, see Jornandes, *De Getarum sive Gothorum Origine et Rebus gestis*; Isidorus, *Chronicon Gothorum*; Procopius, *De Bello Gothico*. The first two are not to be trusted implicitly when they treat of the remote genealogy and origin of the Gothic race.

GÖTTINGEN, a principality of the kingdom of Hanover, erected in the year 1803, lies between 51° 19′ and 51° 53′ N. lat. and 9° 24′ and 10° 9′ E. long. It is bounded on the north by Brunswick and the Hanoverian province of Grubenhagen, south by Prussian Saxony and Electoral Hesse, and west by the last-mentioned and Westphalia. Its area is about 640 square miles, and it contains seven towns—Göttingen; Nordheim, a manufacturing town on the Ruhme, with 3700 inhabitants; Hannöverisch-Münden, at the confluence of the Werra and Fulda, another manufacturing town, with about 600 houses and 4650 inhabitants; Dransfeld, with about 1400; Hardegsen, about 1300; Moringen, about 1600; and Uslar, a mining and manufacturing town of about 2000. The principality has also seven market villages and 327 other villages and hamlets. The surface presents a continued succession of hills, offsets of the Harz, with larger or smaller valleys between them. The soil of the more elevated parts is stony, but the lowlands are highly productive. The western borders from Münster northwards are watered by the Weser; the Leine traverses the principality in its whole length; and the Nieme, Schwülme, Ruhme, and Gaste are among the minor rivers. There are no lakes, but several large pieces of water, and a few morasses. The only mineral spring is at Nordheim. The climate is temperate, and the atmosphere clear and salubrious. Every part of the soil (of which about 84 parts in every 100 are arable, which is susceptible of cultivation) has been turned to account, and large quantities of grain are exported. Potatoes are extensively grown; flax is a staple produce of the country, and much tobacco and rapeseed are raised. With the exception of the environs of Göttingen and Münster, horticulture is not much attended to. There are large forests and good pastures, though the latter, the extent of which does not exceed 16 acres in every 100 of the whole area, do not feed cattle enough for the consumption: the flocks have been increased and improved; horses are imported, as the number reared is not adequate to the demand; numerous herds of swine are kept; and much honey and wax are made. The mineral products are iron, salt, basalt, freestone, millstones, potter's and porcelain clays, coals, and alum. The manufactures consist of linen yarn and linens, iron and copper ware, deals, mirrors, glass, pottery, woollens, leather, paper, &c. The number of inhabitants in 1812 was 96,593, and it is estimated at present at 118,000: that of the houses was, in 1812, 14,573; and in 1832, 15,110. The Lutheran religion is professed by 16 out of every 17 individuals.

GÖTTINGEN, the capital of the preceding principality, is situated in a broad and fertile valley interspersed with gentle eminences, at the foot of the Hainberg, a naked mountain; in 51° 31′ N. lat. and 9° 56′ E. long. It is built on both sides of the New Leine, an artificial arm of the Leine; at an elevation of about 470 feet above the level of the sea, and at a distance of about 140 miles south of Hamburg, and 50 south of Hanover. The name of Göttingen first occurs in a record of the times of the Emperor Otho I., who bestowed it upon the monastery of Poelde, together with its church and tolls, under the designation of 'Villa Gotinge.' About the year 1360, it became a member of the great Hanseatic league; but it owes its modern celebrity to the university instituted by George II., king of England and elector of Hanover, in the year 1734. The town is surrounded by ramparts, which have been levelled and laid out in agreeable plantations and avenues of lime-trees. It is divided into the Old Town, New Town, and Masch; has four gates and some inconsiderable suburbs. It is in general well built, and the streets are mostly broad, straight, and paved with basalt: the houses are about 1060 in number; and the population, without the students, which was 8967 in 1812, and 11,053 in 1822, is at present about 11,500. There are three squares or open spaces, the chief of which are the market-place with a fountain and basin, and a handsome esplanade. The churches consist of five Lutheran parish churches, a reformed Lutheran church, and a Roman Catholic place of worship: the principal of these is St. John's, with its two spires, 200 feet in height; St. James's, which has a steeple 300 feet high, and St. Nicholas's, the university church. The other edifices of note are the guildhall, hospital, and the university buildings. The last with their museums, &c. form the principal objects of attraction.

The university, entitled the 'Georgia Augusta,' was opened in 1737, although the imperial sanction was given in 1733. At the jubilee in 1787 it was found that it had been attended by 14,698 students (about 294 per annum on the average), the maximum of attendance in any one year having been 947. The number had risen in later years to 1400 and upwards, but it has more recently declined to 900 and less. The king of Hanover is the Rector Magnificus, and one or more of his ministry are the curators; but the immediate control is vested in a pro-rector, one of the regular professors. It has four faculties: theology, law, medicine, and philosophy. The library, which has been selected with a view to usefulness, contains upwards of 300,000 volumes and 5000 manuscripts. There is an ecclesiastical school, called the Homiletic Seminary, a museum which contains paintings, collections for the purposes of experimental philosophy, models and casts, coins, machines, &c., a handsome and well-provided observatory under the conduct of two astronomers, a lying-in asylum, chemical laboratory, an anatomical theatre and lecture-rooms, a veterinary school, a clinical establishment and medico-chirurgical

hospital, a philological seminary, a botanic garden and a nursery, and a hall, endowed with funds towards providing meals for poor students; the whole under the management of the senate and professors. There are yearly exhibitions, or stipends, for the benefit of students with slender means. It would perhaps be difficult to name any place of learning the history of which is so instructive as that of Göttingen. With moderate means, under the wise and paternal care of Münchhausen, it soon rose to the highest rank among the schools of Germany, and it has preserved to the present day a constantly increasing reputation for able teachers in every branch of knowledge. Göttingen has also a royal society of sciences, a German society, a gymnasium, a school for females of the upper class, a school of industry, seven elementary schools, five printing establishments, &c. The review, called the 'Göttingische gelehrte Anzeigen,' is the oldest and one of the most celebrated in Germany: it was begun in 1739. The expenditure of those connected with the university forms the principal means of subsistence to the inhabitants: but they have also considerable manufactures of woollens, tobacco, leather, soap and candles, musical and scientific instruments, stockings, &c. The linen trade is also extensive. There is an institution for the relief and employment of the poor, an infirmary, and an orphan asylum. The town is surrounded by country-houses and gardens, and forty fountains and pumps within it are supplied through pipes from the 'Reinhards-börne,' the water of the Leine being muddy and unpalatable.

The fourth and the twentieth numbers of the 'Quarterly Journal of Education' contain an account of the library of Göttingen and its administration, with a sketch of the history of the university, and its condition in 1835

GOTTORP. [Schleswig.]

GOTTSCHED. [Germany, *Language and Literature.*]

GOUDA, a town in the province of South Holland, situated on the Yssel, at the confluence of the Gouw, in 52° 3′ N. lat., and 4° 51′ E. long., distant 12 miles north-east from Rotterdam. The town is surrounded by wide and deep ditches, and, by means of sluices, the surrounding country can be laid under water in a few hours. The church of St. John the Baptist is a large handsome building, and contains a very fine organ: its painted windows are much admired, and they are preserved with the greatest care. Gouda is a place of considerable trade, and contains 12,000 inhabitants. Manufactories of pottery and tobacco-pipes are established there: of the latter there were at one time upwards of 300 establishments.

GOUGH, RICHARD, an eminent English antiquary, son of Henry Gough, Esq., was born in Winchester Street, London, October 21, 1735. He became a fellow-commoner of Benet College, Cambridge, in July, 1752, but left the University in 1756, without taking a degree. He was elected F.S.A. in 1767, and in 1771, upon the death of Dr. Gregory Sharpe, Master of the Temple, was chosen director of the society, an office which he held till 1797. He was elected F.R.S. in 1775. Mr. Gough's first publication of importance was his 'Anecdotes of British Topography,' 4to., Lond., 1768, reprinted and enlarged in 2 vols. 4to., 1780. In 1773 he formed the design of a new edition of Camden's 'Britannia,' which he had partly begun to translate before, and for the purpose of making additions to which he had for years made regular excursions through the different counties of England, Wales, and Scotland. His edition of the 'Britannia' was at length published in 1789, in three volumes folio; reprinted in four volumes folio, 1806. In 1786 he published the first volume of the 'Sepulchral Monuments of Great Britain, applied to illustrate the History of Families, Manners, Habits, and Arts, at the different Periods from the Norman Conquest to the Sixteenth Century.' This splendid volume in folio, which contains the first four centuries, was followed in 1796 by a second, containing the fifteenth century; and in 1799 by an Introduction to the second volume, with which he thought proper to conclude his labours, instead of continuing them to the sixteenth century, as he first intended.

Among his publications of a minor kind were 'An Account of the Bedford Missal,' 'The History of Pleshy, in Essex,' 4to., 1803, and in the same year 'An Account of the Coins of the Seleucidæ, Kings of Syria,' 4to.

He was the improver and editor of Martin's 'History of Thetford,' 4to., 1780; published a new edition of Vertue's 'Medals, Coins, and Great Seals,' by Simon; and in the same year contributed a preface and glossary to Mr. Nichols's collection of 'Royal and Noble Wills,' 4to.

Mr. Gough drew up, at the united request of the president and fellows, the 'History of the Society of Antiquaries of London,' prefixed to the first volume of their 'Archæologia,' in 1770; and to the eleven succeeding volumes of that work, as well as to the 'Vetusta Monumenta,' he contributed numerous valuable memoirs. He was equally liberal to Mr. Nichols's 'Bibliotheca Topographica Britannica,' and to his 'History of Leicestershire.'

Mr. Gough died February 20th, 1809, and was buried in the churchyard of Wormley, in Hertfordshire. By his last will he bequeathed to the University of Oxford all his printed books and manuscripts on Saxon and Northern literature; all his MSS., printed books, prints, maps, and drawings illustrative of or relating to British topography; his interleaved copies of his three greater works already mentioned, and all his unengraved drawings, of sepulchral monuments; with fourteen volumes of drawings of sepulchral and other monuments in France; the engraved copper-plates of his greater works, &c. The remainder of his library and collections were sold by auction in 1810 and 1812; the printed books producing 3552*l.* 3*s.*, and the prints, drawings, coins, and medals, 517*l.* 6*s.* 6*d.*

(*Biogr. Pref.* to the Catalogue of Mr. Gough's Library; Nichols's *Literary Anecdotes.*)

GOURD, a kind of fruit obtained from various plants of the natural order Cucurbitaceæ. In countries having hot and dry summers the different kinds of this fruit are held in high estimation, and are a valuable article of consumption, acquiring a very large size, abounding in nutritious matter, and being moreover very wholesome. The largest is the kind called Potiron Jaune by the French, which sometimes weighs above 2 cwt. All the most esteemed kinds belong to the genus Cucurbita, the species of which are almost entirely destitute of the bitterness that renders other fruits of the same natural order unfit for food. thus the vegetable marrow is supplied by the Cucurbita ovifera; the potiron by C. maxima; the squash gourd, a very delicate sort, and perhaps the most agreeable of all when cooked in a very young state, by C. melopepo; and the orange gourd by C. aurantia. Bottle gourds, which are bitter and dangerously drastic, are the fruit of Lagenaria vulgaris; while what is called the colocynth gourd, a powerful purgative, is in reality a kind of melon, the Cucumis colocynthis.

GOUT (*gutta*, a drop). This name was given to the disease which we are about to describe, from a fanciful notion that it arose from some morbid matter, deposited by drops in the joints. In technical language Gout is called *Arthritis* or *Podagra*. It may be defined to be an inflammatory affection of the joints, arising from some peculiar morbid action in the system, the nature of which is unknown. It is mostly an hereditary disease, coming on without any evident external cause, generally preceded by disorder of the digestive organs, and accompanied by a plethoric state of the system. The inflammation attacks the smaller joints, particularly the first joint of the great toe, and returns at intervals, various joints or parts becoming affected after repeated attacks.

There have been many theories and much discussion respecting the intimate nature of gout, but, after ages of inquiry, we know this affection only by its symptoms and the effects to which it gives rise. We have yet to learn its essential nature, or the special cause which produces it. Much of the obscurity and complexity which exist in the history of gout is owing to the various anomalous affections which have been described as forming a part of the disease, but which are in a great measure incidental derangements and disorders occurring in a gouty constitution or along with an attack of gout, and which may exist in connection with many other maladies. Thus we read of atonic gout, which is only this disease occurring in a person of debilitated constitution, when it is consequently modified in its effects.

A paroxysm of gout is generally preceded by some constitutional disturbance, though it may attack a person suddenly who is apparently in good health. It is commonly ushered in by a disordered state of the whole system; both the circulating, nervous, digestive, and secreting organs are out of order. The pulse is frequent and full; there is a feeling of repletion and oppression; drowsiness, or restlessness; general lassitude and depression of spirits; flatulence;

irregular appetite; costiveness; and high coloured urine, which deposits a pink sediment on cooling. The local affection generally commences suddenly in the middle of the night. The patient is awakened at two or three o'clock in the morning with acute pain in the ball of the great toe, accompanied with a feeling of heat and stiffness of the part: chilliness and fever come on, which gradually abate as the pain increases, which becomes more violent every hour, having a burning or gnawing character. This generally continues till the middle of the following night, though in slight cases it may remit after a few hours' duration. A gentle perspiration then breaks out, and the patient falls asleep. The next morning the toe is shining, red, and swelled; the veins of the foot are very much distended, and the joint is excessively tender. Exacerbations, becoming less violent each time, recur for several nights, and then the attack declines. The joint remains swelled and weak for some days, and there is violent itching, followed by desquamation of the cuticle; after which all disease ceases, and the patient feels better, both in body and mind, than before the attack.

Such are the history and course of a simple fit of gout, as it generally occurs on its first attack. In subsequent seizures, the inflammation, on subsiding in one joint, frequently attacks another, and eventually several joints may be attacked in succession, or two or more at the same time, as the fingers, wrists, and knees. Generally the intervals between the attacks grow shorter, the patient has more and more frequent fits, and they last longer; but this will depend in a great measure on the treatment pursued, and the mode of life of the patient. The fits are more liable to occur in the spring and autumn than at other seasons, owing perhaps to the greater variableness of the weather at those times of the year. After repeated attacks the joints may become stiff and rigid: deposits of whitish matter, called chalk-stones [CALCULI] (which principally consist of urate of soda), will take place beneath the skin, so that the joints of the fingers and toes become enlarged and swollen.

It is very common, when persons have had gout for a length of time, for various internal organs to become diseased. The inflammation may suddenly disappear from a joint, and some serious internal affection, as apoplexy or gastritis, unexpectedly make its appearance. This is called retrocedent or displaced gout. The internal affections which thus arise are often caused by the patient's imprudence, and sometimes by injudicious treatment, as the application of cold to the inflamed joint.

We have mentioned among the precursory symptoms of an attack of gout, that the urine is frequently turbid, and deposits a lateritious sediment. There seems to be a tendency to throw off morbid matter from the overloaded system by this outlet. It has been said that gout favours the formation of urinary calculi, and numerous cases are related where stone in the bladder, or gravel, has occurred in connexion with this disease. Irritation of the urinary organs is certainly very common in gouty persons.

Gout is more frequently met with in persons of vigorous and robust constitutions, than in those of spare habit; and is more common in men than in women: this comparative immunity of the female sex seems to be owing in a great measure to their more temperate habits of life. Persons of advanced and middle age are more liable to gout than those of early life. It does not commonly appear till after the age of thirty-five, though where the predisposition is strong it may occur even before puberty. Hereditary predisposition is doubtless one of the strongest causes of gout, and where this tendency exists the disease may take place under circumstances which would not otherwise have power to produce it. Hence persons who are conscious of an hereditary taint should guard with particular care against the causes which excite gouty action. The most active of these is a plethoric or inflammatory state of constitution, arising from luxurious living, indolence, and sedentary habits; which also give rise to that disordered state of the digestive organs which constantly precedes an attack of gout.

Where the predisposition, both hereditary and acquired, strongly exists, a very slight cause may excite the paroxysm. A fit of intemperance, or excessive indulgence in eating, may bring it on. Excitement of mind from anxiety or intense study will sometimes cause a fit of gout; and it has been known to follow violent exercise, particularly walking. An accident or injury of a joint, occurring in a gouty subject, instead of causing simple inflammation, may give rise to an attack of gout. Gout possesses a considerable resemblance in many of its characters to rheumatism, and these affections may possibly in some instances be confounded together. There are even modifications which partake so much of the characters of both, that it is difficult to assign them to either disease, and they go by the name of rheumatic gout. Gout however may generally be known from rheumatism, by its attacking persons later advanced in life and of a full habit; by its affecting principally the smaller joints, and being commonly confined to one, at least in its earlier seizures; the attack of gout also declines more quickly, is preceded in most cases by disorder of the digestive organs, and is not brought on by any external exciting cause, as cold and damp, which is mostly the case in rheumatism.

The occurrence of a paroxysm of gout often seems to relieve the general health for a time; and it is a common idea that an attack expels some morbid matter from the system. Persons have therefore thought that the more severe the fit is the better; and that they should improve their health by hastening its return. This idea has often led to very improper and even dangerous proceedings. On the contrary, the judicious plan of treatment in gout is to moderate the paroxysm and prevent its recurrence. It would be here unnecessary to enter into any detail of the numerous plans of treatment and the remedies which have been adopted in gout. With regard to the preventive treatment, we need only recommend temperance and exercise, which will generally succeed in keeping off a recurrence of the disease, and if strictly adopted will be a sufficient guidance to the gouty patient. There is an old Scotch proverb, and a very true one, 'that a man might cure himself of gout by living on sixpence a day, and working for it.' The treatment of the paroxysm is very simple. The inflammation should be subdued in this case by the same means as would be requisite in inflammation from any other cause. If the patient is plethoric, and there is active fever, we must bleed, purge, and starve him. Should there be less constitutional disturbance, we may safely leave the fit to run its course; for gouty inflammation has a natural tendency to subside spontaneously, without terminating in suppuration.

Topical remedies are of little use in gout. Warm applications do no good, and cold ones may do serious harm by suddenly checking the inflammation, and bringing on dangerous affections of internal organs. If anything is applied to the part, a warm evaporating lotion is perhaps the best thing.

In addition to the general antiphlogistic treatment which we have mentioned, we possess a remedy which certainly is highly valuable in gout, viz. colchicum. This medicine, when given in a sufficient quantity, generally purges the bowels, and lowers the pulse. A large dose of this drug, given when the occurrence of a paroxysm is threatened, will often avert it altogether, but the prudence of this mode of proceeding is very questionable; it only suppresses the paroxysm, without removing the constitutional disorders on which the disease depends. Colchicum may be given with safety during a fit of gout, and it certainly seems to shorten its duration. If the patient is very plethoric and feverish, blood should first be abstracted; the colchicum (of which the wine of the seeds is one of the best preparations) may then be given, and repeated in moderate doses three or four times a day, either alone, or combined with purgatives. As soon as free purging is produced, the symptoms are generally relieved. Some authors are of opinion that the colchicum does no good without it acts upon the bowels; but in many instances, before this effect is produced, it will allay the pain, bring down the pulse, and stop the progress of the paroxysm. Colchicum is said to increase the secretion of uric acid by the kidneys, and thus perhaps the formation of chalk stones may in some degree be prevented. This drug is the active ingredient in the *eau médicinale* and other quack medicines which are in general use as specifics for the cure of gout.

With respect to the treatment of the complex conditions and different varieties of gout, it must be directed to the improvement of that disordered state of constitution upon which they depend.

Persons of a gouty habit are liable to certain inflammatory affections of the eye (dependent on the state of the constitution), which differ in some respects from inflamma-

tion of the same parts arising from other causes. The external proper tunics, particularly the sclerotica, may be affected in the gouty; though in this case the iris generally participates in the inflammation. The sclerotica and conjunctiva may however be attacked without the iris in gouty persons; this affection is then similar to that modification of external ophthalmia which occurs more frequently from exposure to cold in persons who suffer from rheumatism, and is denominated rheumatic ophthalmia. [RHEUMATISM.]

Sometimes gouty inflammation of the sclerotica is accompanied with an erysipelatous form of inflammation of the conjunctiva. Beer has seen this follow the suppression of gout in the feet by cold.

Inflammation of the iris (arthritic iritis) is a much more common affection than the last in gouty persons, and is usually of an acute character. It commences with uneasy sensations in the eye, which are followed by pain about the orbit, forehead, and side of the head, and lastly in the eye itself. Redness of the sclerotica comes on, which is particularly seen round the cornea; attended with watering of the eye and intolerance of light. The iris soon becomes dull and discoloured, the pupil is contracted, and fixed at one or more points to the capsule of the lens. It has been observed that the red zone round the cornea is less bright in this than in other forms of iritis [IRITIS]; and, as in rheumatic ophthalmia, does not quite extend to the cornea, but leaves a narrow white ring between them. This form of iritis often returns again and again, the eye recovering almost completely after repeated attacks. The iris however often becomes attached to the capsule of the lens by whitish adhesions, though without causing much injury to vision. Mr. Lawrence says that gouty inflammation, when severe and long-continued, sometimes causes complete disorganization, with puckering, and tubercular projection of the iris, and extinction of sight. When arthritic iritis occurs in a person of plethoric habit, we must bleed and adopt general antiphlogistic treatment. Colchicum may also be given with advantage. Mercury seems to do more harm than good in this affection. The recurrence of the disease must be prevented by such means as remove the gouty disposition.

Besides the affections which we have described, persons of a gouty constitution are sometimes attacked with more extensive inflammation of the eye, affecting the internal parts of the globe generally; that is, the choroid membrane, iris, retina, vitreous humour, lens and its capsules, and secondarily involving the sclerotica and cornea. It generally ends in loss of sight, with a dilated pupil and opaque lens; but in some cases the latter change does not take place, and a green discolouration of the pupil remains: in this case, Mr. Lawrence calls the affection *acute glaucoma*. Arthritic inflammation of the internal tunics is a much more serious disease than gouty iritis, and almost invariably destroys sight. It is attended with great suffering; there is severe burning pain, which extends to the face and side of the head; and the eye itself feels distended, or swelled. There is redness of the sclerotica and conjunctiva; dulness of the cornea and iris; the pupillary margin of the latter is turned backwards, and the opening itself dilated and fixed. The lens becomes opaque, and often of a greenish colour, and is pushed forward into the dilated pupil; the eye loses its brilliancy and looks dead. The sight is lost at an early period of the disease. This disorder generally affects both the eyes in succession, and the most energetic treatment has hardly any effect upon it. Loss of blood, and other active measures, must be resorted to in the first stage of the affection. This disease is generally seen in elderly persons of full habit, with bloated red faces which are owing to indulgence in the pleasures of the table.

GOVERNMENT is a word used in common speech in more than one sense. 1, It denotes the *act of governing*, as when we speak of 'the business of government.' 2, The *persons who govern* are, as often as not, called 'the government;' and we thus speak of 'the French government,' 'the Russian government,' &c. 3, The word 'government' is used elliptically for the phrase *form of government*, as when we speak of 'a monarchical, aristocratical, or republican government,' or again of 'the English or French government,' meaning thereby the English or French form of government, or (changing the phrase) the English or French constitution.

Of these three meanings of the word 'government,' the first and the last are considerably the most important. As regards the second, there is no more to be said than has been already said, amounting to such an explanation as finds place in dictionaries. But the other two admit of disquisition. Each of these other two meanings opens out a large and interesting field of inquiry; and correspondent to each of them is a science.

First, there is the science which (to use the briefest mode of expression possible) relates to the business of government; and secondly, there is that which relates to the formation of government. The first of these two sciences enumerates and classifies the operations of governing; the second, the forms of government: and the end of government being the production of the greatest possible amount of happiness for those who are governed, the first seeks to determine how the operations of governing shall best be carried on, and the second how the government shall best be formed, with reference to the attainment of this end. Each of these sciences may be, and sometimes is, called the 'science of government;' the word 'government' in this expression signifying at one time the act of governing, and at another being a short way of saying 'form of government.' But it is important, if this expression be used thus doubly, to bear in mind its two meanings, and the difference between them, as well as the existence of two distinct sciences of government; by confounding or forgetting which some writers on government have fallen into grievous errors.

The science of government, in the first of the two senses, or the science which relates to the business of government, is more commonly called the science of legislation. So the art which flows from this science, or the art of governing, is called the art of legislation. In accordance then with the common phraseology, we shall now dismiss this first of the two sciences, and together with it that sense of the word 'government' in which it signifies the act of governing; reserving them for treatment under the head LEGISLATION. In the present article we shall concern ourselves exclusively with the second of the two sciences, and with that sense of the word 'government' in which it stands for the phrase 'form of government.'

We begin with enumerating the various forms of government. Having made this enumeration, we shall proceed to consider abstractly which of these various forms is best fitted to attain the end of government, or is fitted to produce the greatest amount of happiness for the governed. When we say that we shall consider this question abstractly, we mean that we shall make abstraction of all local and occasional circumstances which are incidental to particular states, as well as of the present existence of some particular form of government in each particular state, and of the difficulties standing in the way of its removal. Abstraction of these circumstances is made in that science of government of which it is our purpose to treat.

It is hardly necessary to explain the phrase 'form of government,' though, if it were necessary, many explanations might be given of the sort supplied by a change of phrase. Thus we might say that the form of government is but another and a shorter phrase for the mode of distributing the powers of government, or ('powers of government' and 'sovereignty' being interchangeable expressions) of distributing the sovereignty in a state. And many other changes of phrase, which it is not worth while to enumerate, might be devised. Or we might explain the phrase by enumerating the various items which it comprehends. Thus, not professing now to make anything like a complete enumeration, we might say that the number of the governors or governing bodies, their relations to one another (if more than one), and the modes in which they are severally appointed, are so many elements of a form of government. But it is obvious that an enumeration of these elements will be contained in the enumeration of forms of government, which we now proceed to make.

1. A government consists either of one person or of more than one.

When it consists of one person only, the appropriate name for the form of government would be *monarchy*. But we shall see hereafter that this name is generally, in common speech, fantastically bestowed on a particular class of governments of more than one; while a government of one only is called by the names of *absolute monarchy*, *despotism*, and *tyranny*. Of these three names, the last two may be objected to as names, because they always imply disapprobation, or because they are not only names, but also (to

employ Mr. Bentham's phraseology) words dyslogistic. But the essence of this form of government is the complete dependence of the governed on the will of one person, which is well expressed by the terms despotism and tyranny; and the sense of disapprobation which hangs about these terms, or their dyslogistic character, is to be traced to the accidental circumstance of the conjugate terms *despotic* and *tyrannical* being commonly used to describe other forms of government, in which the arbitrary conduct of the governors resembles that of the generality of despots or tyrants.

2. A government of more than one may either consist of one homogeneous body, or (changing the phrase) of one body all whose members are appointed in the same way, or it may be mixed, compound, or consist of heterogeneous parts.

When the members of the one governing body, if hereditary, are a decided minority of the state, or, if deriving their powers from without their own body, they so derive them from a portion of the state which is yet a decided minority, the government is called by the names *aristocracy* and *oligarchy*. There is a difference in the use of these two terms which it is impossible to mark exactly. But it may be said roughly that the term oligarchy is used where the minority is very small, and the term aristocracy where it is not. The latter term also would be always employed where the members of the governing body derive their powers from without, or where the body is elective.

When again the members of the one governing body either themselves constitute, or derive their powers from, a portion of the state which is a decided majority, the government is called a *democracy*.

3. Before proceeding any further with that series of divisions, in which we have now taken two steps, we may remark that the three forms of government of which we have now spoken, viz. absolute monarchy or despotism, aristocracy or oligarchy, and democracy, are commonly called (as being governments of one person, or of one homogeneous body) pure forms of government, in contradistinction to the mixed forms which yet remain to be considered. The division of forms of government into pure and mixed is a complete division, which the common division into monarchy, aristocracy, and democracy, is not.

4. A mixed form of government is one compounded of the whole or of any two of the three elements which exist separately in the three pure forms of government, and also of individuals or bodies deriving their powers from different portions of the state, even though each of these different portions is a decided majority of the state. It is not necessary to enumerate all the mixed forms of government which arise from all the possible combinations. Besides that all the possible combinations may be easily seen, some of them produce forms of government which have never existed, and which consequently are no objects of interest. It will be sufficient then to speak of those combinations, or rather of those classes of combinations, with which men are familiar, and for which common speech supplies names.

The mixed forms of government which occur may be divided into two classes, according as an hereditary chief does or does not enter into their composition.

Governments which contain an hereditary chief united either with an aristocratic and a democratic body, or with an aristocratic body by itself, or with a democratic body by itself, are generally called *monarchies*. They are also called *limited monarchies*, as if to distinguish them from the governments of one only, to which, as we have said, the name monarchy more appropriately belongs, but to which, without the epithet *absolute* being prefixed, it is seldom or never applied.

As regards the governments of which an hereditary chief forms no part, it will be convenient to observe at the beginning, that the combinations of an elective chief with one or more democratic bodies are the only combinations which possess any interest for men; if indeed, judging from the past, we may not also say that they are the only ones which are practicable. And having premised this, we may say that the governments into the composition of which an hereditary chief does not enter are generally called *republics*, or *representative governments* (the relation of the democratic body or bodies in the government to the portion or portions of the state that appoint them being known by the name representation), or again, *pure representative governments*, as if to distinguish these from the forms of government in which a democratic body is united either with an hereditary chief and aristocratic body together, or with either of these by itself.

Thus far we have been employed in enumerating the forms of government. In our mode of enumeration we have been guided entirely by the terminology in common use, and have not sought to twist the names which men commonly apply to different forms of government, so as to make them suit a fanciful division of our own. We have thus adopted a mode of enumeration different from that of (we may say) every systematic writer on government. It concerns us to remark likewise, that we have abstained, by reason of the limits necessarily imposed on an article like the present, from adducing instances and illustrations of the different forms of government of which we have spoken. But after all, if we put out of view the lively and popular character that they are calculated to impart to an article, the real advantage of such instances and illustrations is slight. Few readers would need to be informed that the governments which generally prevail in Asia are despotisms, or that the government of England is one of those mixed governments which go by the name of limited monarchies, or again, that the governments subsisting in the United States of North America are representative governments, or republics.

We proceed now to consider the question, which is the best form of government? And in considering this question, we make abstraction, as has been already intimated, of all local and occasional circumstances which are incidental to particular states, as well as of the present existence of some particular form of government in each particular state, and of the difficulties standing in the way of its removal.

Now a government is a means to a certain end. The best form of government is that which is best adapted to the attainment of the end. 'The question with respect to government' being then, as Mr. Mill begins his well-known essay by observing, 'a question about the adaptation of means to an end,' it is necessary that we should first enunciate the end.

The end of government is the production of the greatest possible amount of happiness for the governed. Strictly and more largely, its ultimate end is the production of the greatest possible amount of human happiness. But inasmuch as each government contributes most to increase human happiness generally by applying itself to the production of the greatest possible amount of happiness among that particular portion of mankind over which it is set, and inasmuch as the attainment of the larger and general end is thus included in the attainment of the smaller and special end, it is sufficient, while it is more convenient for our purpose, if we keep in view the latter of the two ends only. With regard to the term happiness, by which we express the end of government, it is unnecessary that we should here analyze it. Suffice it to observe, that it comprehends pleasures intellectual and moral, as well as pleasures of sense, and that the increase of knowledge and intelligence, and the moral improvement of a nation, are among the most valuable of the objects included in the general end, happiness, which it is the duty of a government to strive after.

Now a government will have a greater or less tendency to increase the happiness of those who are governed,—

1. According as it is controlled, whether in the way of participation, or of election and consequent responsibility to the elector, by a greater or smaller number of such as, having an interest favourable to good government, are fit respectively to participate or to elect.

2. According as it tends, by its mode of construction, to prevent or to create diversity of interests.

3. According as it interferes less or more with those pursuits which are necessary to a very large majority of every community for the attainment of a livelihood.

The union of these three considerations, which seem to be all that are pertinent to the subject, leads us to what we have called above a pure representative government. The first of the three makes for the existence of a democratic body, or union of such bodies, in the government; and while the second leads us to conclude against uniting with this body, or these bodies, a body of an aristocratic character, or an hereditary chief, the third points out one chief advantage of a democratic representative body, or union of such bodies, as compared with a government in which the great majority of the state directly participate.

It is necessary to enforce at somewhat greater length the considerations which we have adduced, and by which alone we test forms of government. In doing so however, we shall not observe the order in which we have named them, but shall adopt a line of argument which leads most directly and conveniently to the 'foregone conclusion' of a pure representative government.

It is desirable, in the first place, that the powers of government should not be vested solely in an individual, or in an aristocratic body, or (in other words) that the form of government should not be an absolute monarchy or an aristocracy, because there is a great probability that the despot or the aristocratic body will pursue respectively his or their own interest, to the detriment of the great bulk of the community, and because further the great bulk of the community are in such cases deprived of the means of improvement which a participation in government supplies. This improvement, we have already observed, is one chief way in which government may contribute to increase the happiness of the community. With reference to the probability of a despot or aristocratic body abusing his or their power, it is important to observe that we affirm no more than a probability. Some despots, or absolute monarchs, there have been in every way deserving of praise. There may have been also aristocratic bodies whose use of the powers possessed by them has been conducive to the general interest. But these are the exceptions. It is clearly in the nature of things probable that there will in such cases be an abuse of power; and the abstract question concerning forms of government is, after all, only a question of probability,—which form of government is it probable will conduce most to the happiness of a community?

Secondly, it is desirable that a share, whether direct or indirect, in the government should be possessed by as large a number as are likely to be fit to exercise the power thus conferred on them. There are two reasons for this extension of power, correspondent to the two reasons which have been already stated against its restriction to one or a few. First, the greater is the number of those who have a share in the government, the greater is the probability of the general interest being regarded; for the more widely are the powers of government distributed, the less division will there be in the community, and consequently the less will particular interests appear; and further, there is a greater probability, in an extensive distribution of political power, that all the disturbing effects of particular interests will neutralize one another, and merge in the pursuit of the general interest. Secondly, the more political power is extended the more widely will the improvement to be derived from its exercise be diffused.

But, in the third place, it is improbable that any very large number will be fit in any community to be members of a deliberative body, and have a direct share in legislation. Further, besides their being unlikely to possess the requisite amount of intelligence, it is unlikely that any very large number of men could spare time from such pursuits as are necessary to the attainment of a livelihood for the work of deliberation. Again, an assembly consisting of a majority of the community, or of a number approaching to the whole of the community, would, from its size, be unfit for the purpose of deliberation. For these three reasons it is desirable that the power which is extended through a large number should be one merely of election; and that the democratic body should be one not large and in which the great bulk of the community have a direct share, but small, elected by the great bulk of the community, and (in the common phrase) representing them. A large number will be found fit to elect, though not to deliberate; to judge of the amount of intelligence and honesty possessed by candidates for representation, though not to decide upon the many and important subjects which the representative is required to consider. The act of election, however frequent, will not interfere with the toils necessary for subsistence; and the amount of attention to political subjects occasioned by the duty of election will be sufficient to ensure the general intellectual development which we have spoken of as one of the tests of a good government.

Thus far we have merely been arguing for an extensive distribution of power, with which an hereditary chief or an aristocratic body might very possibly co-exist in the government. It remains to complete the argument by pointing out the objections to a mixed government, or to a government which, by its very mode of construction, creates a diversity of interests. First, in so far as particular interests are embodied and made separately influential in a state, the attainment of what is for the general interest is impeded; secondly, from the separate embodiment of these particular interests collision ensues (for the much-talked-of balance of powers is only an imagination), and by collision is engendered ill-will. On the bad moral effects of the ill-will thus engendered it is unnecessary to dilate.

Such is a rapid sketch of the abstract argument in favour of a pure representative government; and such may be considered a brief general view of that science of government which employs itself in determining which form of government is best adapted to increase the happiness of the governed, or (briefly) is the best.

It cannot need to be remarked that when, abstracting ourselves from all particular circumstances of time and country, we conclude that a pure representative government is the best form of government, we do not contend either that such form of government should now be established in any particular states or state, or that it ought to have existed in all states in all periods of their histories. It were absurd even to think of a general distribution of political power, such as is implied in a pure representative government, in the early periods of ignorance and mental inactivity. And it were outrageous to attempt to establish in each state, in defiance of the many habits and interests which must have grown up around the forms of government already established, a new one, which is abstractly the best, or (in other words) is the best if we leave these habits and interests out of consideration.

Yet must not this science of government be pronounced idle and unprofitable. It may be out of the question, as generally it will be, to establish immediately, or perhaps even ultimately, that government which the abstract science tells us is the best. But though the goal of perfection be unattainable, it is useful to have it constantly in view. And while it will be the duty of each existing government, learning the feelings of its subjects and profiting by the opportunities of the time, to seek to approach nearer and nearer to that form of government which is abstractly the best, all such changes as are made with distinct reference to this abstract form of perfection will, as being made on the soundest principles, be the best.

GOWER, JOHN, an early English writer, was born in the first half of the fourteenth century. Whether he was older or younger than Chaucer is doubtful; certain it is that they were friends, probably from their college-days. The profession which Gower followed is as uncertain as his birth-year. It appears that he studied law, but the story of his having been some time chief-justice of the Common Pleas wants proof. He was attached to the duke of Gloucester, Richard II.'s uncle, and appears, like Chaucer, to have taken part in censuring the vices and follies of the ecclesiastics of those times. In the latter period of Gower's life it seems nearly certain that a coolness existed between him and Chaucer, and Tyrwhit thinks he has discovered some trace of it in certain expressions of Chaucer, and in the fact that in the second edition of his poems Gower omitted some verses in praise of his friend. As however this second edition did not appear till after the accession of Henry IV., it is probable that Chaucer, who only survived that event about a year, never felt the blow thus aimed against him.

Gower's works are:—1. 'Speculum Meditantis,' a collection in French verse of precepts and examples of chastity; 2. 'Vox Clamantis,' a Latin poem, in seven books, on the insurrection of the Commons under Richard II.; 3. 'Confessio Amantis,' which is written for the most part in English octave verse, with interspersed Latin elegiacs and Latin prose tables of contents, something like the well-known running commentary to the 'Ancient Mariner.' It consists of eight books and a prologue, and in some parts takes the form of a conversation between the lover and his priest, where story and disquisition are heaped on each other in the most unsparing profusion, with the intention apparently of solacing the lover.

The 'Confessio Amantis' was written towards the end of Gower's life, and appears by its form to have indicated a wish on his part to conform to that taste for English poetry which Chaucer had awakened among his countrymen. As a poet he ranks very far below his friend. His verses are tedious, overladen with misplaced learning not even poetically introduced; and it seems pretty evident that had

Chaucer never lived, Gower would have continued to the end of his days a composer of Norman couplets and Latin elegiacs.

Some smaller poems of Gower's remain in the library of Trinity College, Cambridge, but none of any consequence or merit. The only one of Gower's works which is printed is the 'Confessio Amantis,' which went through four editions before the year 1560. Of his history nothing more is known, except that his principal work (the 'Confessio Amantis') was written in consequence of a casual meeting with Richard II., when that prince asked him to 'book some new thing;' that he became blind in his later years, and that at his death he was buried in the church of St. Saviour's, Southwark, where his monument remains. Whatever may be thought of his poems, no one can deny him the praise of having by his benefactions to the above-mentioned building left a monument which no lover of art can pass without admiration.

Gower stands half-way between the minstrel of Normandy and the English poet, and he seems to have transferred the faults of a declining literature into the language of one newly arisen; a warning, if they would take it, for those who prefer striving uselessly at catching and imitating the taste of the day, to excellence, or at least success, in their own original walk of letters. (Warton, *Hist. Eng. Poetry;* Godwin's *Life of Chaucer;* Chalmers, *Biogr. Dict.;* Puttenham's *Art of Poetry;* and Gower's 'Works.')

GOYAZ. [BRAZIL, vol. v., p. 368.]

GOZZI, COUNT GASPARO, a writer of some distinction in the Italian literature of the 18th century, was born at Venice, December 4, 1715. He was educated in a college at Murano, but instead of applying himself to the more serious parts of study, he indulged his natural turn for the belles lettres alone and works of taste. So great indeed were his indolence and easiness of temper, and his aversion to what looked like business, that notwithstanding his patrimonial property was at first very considerable, he suffered it to go entirely to wreck, leaving himself no other resource than his pen. He had consequently many struggles to encounter, nor were his misfortunes much lightened by his marriage with Luigia Bergalli, a lady of considerable literary attainments, but his senior by ten years, and not altogether so amiable in domestic life as in her poetical effusions. She was however a woman of talent, and besides many original dramas and comedies, she made a translation of Terence in blank verse, and likewise one of Racine; besides which she displayed some proficiency in painting. We may therefore credit his biographers when they tell us that he sincerely regretted her loss, notwithstanding the various vexations she had caused him; and more especially as she had borne him a numerous offspring.

His already shattered fortune had, in the meanwhile, been almost totally dilapidated by his wife's undertaking the management of the theatre San Angelo at Venice; whereby he was reduced to such extremity, that he was compelled to make a subsistence by translating for booksellers, and other literary occupation; and is said not only to have assisted Foscarini in his 'Storia della Letteratura Veneziana,' but to have been the chief author of the work, filling up the outline, which was all that had been furnished by the other. At length, after having toiled with his pen till more than sixty years of age, fortune showed herself all at once more propitious; for on the suppression of the order of Jesuits he was entrusted, in 1774, with drawing up a plan for the new public schools, of which he was appointed prefect, with a handsome salary. Here he discharged his duties so much to the satisfaction of the government, that he was afterwards commissioned to re-establish the University of Padua. He removed to that city, and there spent the remainder of his days in comparative affluence and leisure, although a great sufferer from many painful attacks and great bodily infirmities. He died December 25, 1786, aged seventy-three, and was buried in the church of S. Antonio at Padua.

Among his original works, which were first published in a collected form by the Abbate Dalmistro, 1818, in sixteen volumes, the most popular are his 'Sermoni' and the 'Osservatore Veneto,' a series of periodical papers, admirable as well for the elegance of their style, as for their playful well-directed satire, and the sound moral instructions they convey: so that they have obtained for their author the title of the 'Italian Addison.' It has indeed been objected by Ugoni and other critics, that Gozzi was too fond of dressing up his subjects in the form of allegorical narrative, yet many of them display much invention and great ingenuity; and the dialogues after the manner of Lucian, of whom he was a great admirer, such as that between Ulysses and those who have been transformed by Circe into animals, are replete with acuteness and satire. He was a no less enthusiastic admirer of Dante than of Lucian, as is proved by his 'Difesa di Dante.' Among various other works translated by him are the 'Daphnis and Chloe' of Longus, the 'Table of Cebes,' Pope's 'Essay on Criticism,' Fleury's 'Ecclesiastical History,' and Marmontel's 'Tales.'

GOZZI, COUNT CARLO, brother to the preceding, was born in March, 1722. At a very early age he displayed a taste for literature, and applied himself with such immoderate diligence to reading, as to subject himself to frequent fits of syncope, in the course of which he was at four different times supposed to be actually dead. Equally precocious in his passion for literary composition, before he had well completed his sixteenth year he produced four poems of considerable length ('Il Berlinghieri,' 'Don Chisciotte,' 'La Filosofia Morale,' and 'Gonella,' in twelve cantos), besides a great number of fugitive pieces both in prose and verse, and a translation of Marivaux's 'Pharsamon.' At length, in order to escape from rapidly-increasing family embarrassments occasioned by his father's extravagance and by his brother Gasparo's bad management, he accompanied the Proveditor Querini to Dalmatia, where he continued about three years, and while there he began to apply himself assiduously to the study of mathematics and fortification. On his return to Venice he was for a long time occupied entirely with domestic matters and in endeavouring to rescue the mortgaged and alienated estates of the family; till, grown weary of constant litigation, he again took up his pen, and in 1761 brought out his first dramatic piece, entitled the 'Three Oranges,' and written for the purpose of supporting the Sacchi company, whose theatre had become almost deserted for that of Goldoni. Its success was so complete that he followed it up with a succession of similar dramas, all founded upon Venetian Fiabe, or stories of wonderful adventures and enchantments, derived from Eastern countries, where their scene is uniformly laid. For the Venetian public these pieces had the novel attraction of abundant spectacle, action, and stage bustle, in addition to that of the Maschere of the Italian theatre, and their impromptu dialogue, which Goldoni had endeavoured to banish, and which Gozzi was anxious to revive. They also abound in varied and striking situations, both tragic and comic, and in scenes of Aristophanic humour and licence, in which the author did not at all spare either Goldoni or his other dramatic rival, Chiari. The fame of these romantic tragic and comic pieces soon extended itself to Germany, where the wildness and marvellousness of their plots gained them many admirers; among the rest, of Schiller himself, who has given his countrymen a free translation of that entitled 'Turandotte.' Besides which, a complete German translation of them appeared at Berne, in five volumes, in 1777. In fact Gozzi has been more liberally commended by foreigners, Ginguené, Schlegel, De Staël, &c., than by Italian critics, some of whom have accused him of being trivial both in his language and his sentiments.

He afterwards composed a number of other dramas, partly translated, partly borrowed from various Spanish authors; also a humorous poem in twelve cantos, entitled 'Marfisa Bizzarra.' Further he has, like his rival Goldoni, given us his autobiography under the whimsical title of 'Memorie Inutili della sua Vita, scritte da lui medésimo, e pubblicate per Umiltà.' This work was never completed by him, but he discontinued it after the part printed in 1798, notwithstanding that he lived several years longer, for his death did not take place till April 6, 1806, when he had attained the age of eighty-four.

GOZZO ISLANDS belong to Malta, and consist of two rocks, Comino and Gozzo, which are covered with earth, and not much elevated above the surface of the sea. Comino, the smaller of them, is nearest to Malta. It is only about 3000 yards in circumference, and yet has a population of more than 900 souls. Gozzo, which lies farther to the north-west, has a surface of less than 40 square miles, and 15,000 inhabitants, many of whom are occupied in spinning cotton, the principal production of the island. There are some small ports on this island: Gozzo, the principal place, contains about 3000 inhabitants, and near

it is a small fortress, called Rabatto. Gozzo is the Gaudus of Strabo (Casaub., p. 277).

GRAAF REYNET. [CAPE OF GOOD HOPE.]

GRABE, JOHN ERNEST, was born at Königsberg, July 10, 1666, and was educated at its university, in which his father Martin Sylvester Grabe was professor of divinity and history. He applied himself diligently to the reading of the fathers, and was led by the perusal of them to question the validity of the ordination of ministers in the Lutheran church. He therefore resolved to embrace the Roman Catholic faith; but first presented to the ecclesiastical consistory at Sambia in Prussia a memorial containing his doubts and difficulties. Three Lutheran divines were commanded by the elector of Brandenburg to reply to this, but, unable to convince him, they recommended him to go to England, where he would find a clergy which derived their right to the ministry from apostolical succession. In accordance with their advice he came to England, where he was well received by William III., who settled a pension upon him. He took orders in the Church of England, and was made D.D. by the University of Oxford, April 26, 1706. He died in London, November 13, 1711, in his forty-fifth year, and was interred in Westminster Abbey. Dr. Hickes has given an interesting account of the life of Dr. Grabe, from which we learn that he was in favour of prayer for the souls of the dead who died in faith, for anointing the sick with oil, for confession and sacerdotal absolution, and that he used to lament that the Reformed churches had discarded many primitive customs which were retained in the Roman Catholic church.

Dr. Grabe published many works, of which the most celebrated is his edition of the Septuagint, printed at Oxford in 4 vols. fol. and 8 vols. 8vo., 1707-1720. The text of this edition was founded upon the Alexandrian MS. now in the British Museum. He only lived to superintend the publication of the first and fourth volumes; the second and third, published after his death, were edited respectively by Dr. Lee and Mr. Wigan. Among his other works, the principal are, 'Spicilegium S.S. Patrum,' 2 vols. 8vo. Oxf. 1698-9; 'Justini Apologia Prima,' 8vo. Oxf. 1700; 'Irenæi adversus Hæreses Libri V.' fol. Oxf. 1702; 'Epistola ad Millium,' 4to. Oxf. 1705, to show that the Alexandrian MS. of the Septuagint contains the best version of the Book of Judges, and that the version in the Vatican MS. is almost a new one, made in the third century; 'An Essay upon two Arabic MSS. of the Bodleian Library, and the book called the Doctrine of the Apostles,' 8vo. Oxf. 1711; 'De Forma Consecrationis Eucharistiæ, hoc est, Defensio Ecclesiæ Græcæ contra Romanam,' 8vo. Lond. 1721. (*Life of Dr. Grabe*, by Dr. Hickes, prefixed to a posthumous work of Dr. Grabe, entitled 'Some instances of the Defect and Omissions in Mr. Whiston's Collection of Testimonies,' 8vo. Lond. 1712.)

GRACCHUS, TIBERIUS, was born B.C. 163, and was the son of Tiberius Sempronius Gracchus, a man of some celebrity in the annals of his country, and of Cornelia, daughter of Scipio Africanus.

T. Gracchus the elder died while his sons were yet young; having twice served the office of consul, and, according to Plutarch, obtained two triumphs. Two anecdotes remain regarding him which seem to exhibit him as a Roman of the old class, affectionate, high-spirited, and religious. After the death of her husband, Cornelia refused all offers of marriage, and devoted herself to the charge and education of her children, who, as Plutarch tells us, were less the inheritors of manly virtue by being sprung from the noblest blood in Rome, than they were its possessors from the careful nurture of their mother Cornelia.

Tiberius served his first campaign in Africa under his uncle Scipio, and having obtained the office of consul's quæstor, we find him next under Mancinus, the unfortunate commander in the Numantine war. His name, which the Numantines respected from remembering his father's virtues, is said to have procured the terms under which Mancinus obtained safety for his army; but the senate on his return was so much displeased at the unfavourable nature of the terms, that they resolved on giving up all the principal officers to the Numantines. By the good-will however of the popular assembly, influenced, as it should seem, by the soldiers and their connexions in the lower classes, it was decided to send Mancinus as the real criminal, and to spare the other officers for the sake of Gracchus: treatment of this nature was likely to rouse Gracchus against the senate, and make him the friend of the poor, and accordingly in three years afterwards we find him beginning his short career as a political agitator. He was elected tribune of the Plebs, B.C. 128.

The long wars in which the Romans had been engaged led to the introduction of an enormous number of slaves into Italy. These slaves had taken the place of the regular inhabitants of the country, and tilled the large estates of the rich to the exclusion of the regular labourers. In Sicily they mustered so strong as to maintain themselves for upwards of two years against their masters, backed by all the power of Rome; and in Italy itself the scene which presented itself to T. Gracchus as he returned from Spain was that of a whole country whose only cultivators were foreign slaves. Nor did he find less cause for complaint in the city, crowded as it appears to have been with needy soldiers, whose services had found no remuneration adequate to their expectations.

These causes, acting on a disposition at once ambitious and humane, and aided by the suggestions of a mother, who could not help reminding her sons that she was still called, not 'mother of the Gracchi,' but 'daughter of Scipio,' and by the general voice of the people expressed in placards and memorials addressed to him as to their preserver and champion, combined in inducing Tiberius Gracchus to attempt the revival of the Licinian Rogations. [AGRARIAN LAW.] In so doing he appears to have had in view the two grand principles which that law involved, namely, the employment of freemen in preference to slaves, and the more generally recognised principle of the equitable division of the public land.

Three commissioners were to be appointed to superintend the working of the new law, which Gracchus proposed, if we may trust Plutarch, with the approval of several of the most eminent persons of the time, among whom were Mutius Scævola and Crassus.

Such general interest was excited by the question, that crowds arrived from all parts of the country to support either side; and there appeared no doubt which way the matter would go, when left to the tribes. The aristocracy however secured the veto of M. Octavius, one of the tribunes, and thereby quashed the proceedings whenever the law was brought on, which violent mode of opposition led Gracchus to exercise his veto on other questions, stop the supplies, and throw the government into the most complete helplessness.

Thus far the contest had been lawful, but at this juncture Gracchus, irritated by continued opposition, invited Octavius to propose his (Gracchus's) ejection from the office of tribune, and on his refusal, pleading the utter uselessness of two men so different holding the same office, he put the question to the tribes, that Octavius be ejected. When the first seventeen out of the thirty-five tribes had voted for it, Gracchus again implored him to resign, and on his entreaty proving unsuccessful, polled another tribe, constituting a majority, and sent his officers to drag Octavius down from the tribune's chair. The Agrarian law was forthwith passed, and Gracchus himself, his brother Caius, and his father-in law Appius Claudius, were appointed the commissioners; but the senate, to show their opinion of the whole proceeding, withheld from him the usual allowance of a public officer, giving him only about one shilling a day. While things were in this state, the dominions and treasure of Attalus, king of Pergamus, were by him bequeathed to the Roman people; and to enhance his own popularity, Gracchus proposed to divide the treasure among the recipients of land under the new law, to enable them to stock their farms, and to commit the management of the kingdom of Pergamus to the popular assembly.

This brought matters to a greater pitch of distrust than ever. Gracchus was accused by one senator of aspiring to tyranny, and by another of having violated the sanctity of the tribune's office in deposing Octavius. On this point Gracchus strove to justify himself before the people, but his opponent seems to have gained an advantage so great as to induce him to postpone the assembly. When at last he did make his defence, it rested, if Plutarch is correct, on false analogies and on blinking the question of the inviolability of a public officer.

At this juncture Gracchus seems to have trembled for that popularity which alone preserved him from impeachment; and, lest it should fail, endeavoured to secure his own re-election to the office of tribune.

The other party had demurred as to his eligibility to the

office two years in succession, and on the day of election this point occupied the assembly till night-fall. Next morning, accompanied by a crowd of partisans, he went to the capitol; and on hearing that the senate had determined to oppose him by force, armed his followers with staves, and prepared to clear the capitol. At this juncture, Scipio Nasica, having in vain called on the consul to take measures for the safety of the state, issued from the Temple of Faith where the senate had assembled, followed by the whole nobility of Rome, awed the mob into flight, seized their weapons, and attacked all who fell in their way. About three hundred fell, and among the slain was Gracchus, who was killed by repeated blows on the head, B.C. 133.

GRACCHUS, CAIUS, was nine years younger than Tiberius, and at his death was left with Appius-Claudius as commissioner for carrying out the Agrarian law. By the death of Appius, and of Tiberius's successor, Licinius Crassus, the commission was composed of Fulvius Flaccus, Papirius Carbo, and himself; but he refrained from taking any part in public affairs for more than ten years after that event.

During this time the provisions of his brother's law were being carried out by Carbo and Flaccus, but he does not seem to have begun his career as an independent political leader until the year 123 B.C., when, on his return from Sardinia, where he had been for two years, he was elected tribune of the Plebs. His first act was to propose two laws, one of which, directed against the degraded tribune Octavius, disqualified all who had been thus degraded from holding any magistracy; and the other, having in view Popilius, a prominent opponent of the popular party, denounced the banishment of a Roman citizen without trial. The first was never carried through; to the latter was added a third, by which Popilius was banished Italy (forbidden fire and water). These measures of offence were followed by others, by which he aimed at establishing his own popularity. One of these was a poor-law, by which a monthly distribution of corn was made to the people at an almost nominal price. The effect of this law was to make the population of Rome paupers, and to attract all Italy to partake of the bounty.

Next came organic changes, as they would now be called; and of these the most important was the transference of the judicial power from the senators, wholly or in part, to the equestrian order. This measure, according to Cicero, worked well; but in taking his opinion we must remember his partiality to the 'equites,' and add to this the fact that his eulogium occurs in an advocate's speech. (*In Verrem*, actio i.)

Gracchus now possessed unlimited power with the populace; and at the end of the year, not more than ten candidates having started for the office of tribune, he was again chosen. His second tribuneship was mostly employed in passing laws respecting the colonies, in which matter the aristocratical agent, Livius Drusus, outbid him, and having won the confidence of the people by his apparent disinterestedness, ventured (being himself a tribune) to interpose his veto on one of Gracchus's measures. His appointment soon after to the office of commissioner for planting a colony near Carthage took him away from the scenes of his popularity; and soon after his return a proposal was made to repeal the very law which he had been engaged in carrying out. This law was not his own measure, but that of one Rubrius, another of the tribunes, and was one of those enactments which had weaned the favour of the people from him. He was now a private man, as his second tribuneship had expired, but as such he opposed the proposal, and united with Fulvius, one of the commissioners of the Agrarian law, to incite the populace to acts of open violence.

His partisans collected at the capitol on the day of deliberation, and by their outrageous conduct broke up the assembly. The senate, alarmed at these proceedings, gave the consul Opimius full powers, according to the usual form, 'to take care that the state took no harm.' He collected soldiers and summoned Gracchus and Fulvius to answer the charge of murder. After some attempt at negotiation he attacked the popular party, and soon dispersed them. Gracchus had been too good a citizen to abet in the resistance which his followers attempted, and fled. Being hard pressed he crossed the Tiber, and there, in a Grove of the Furies, commanded his servant to destroy him. He perished when about thirty-three years of age, B.C. 121.

The character of Caius is not nearly so stainless as his brother's; he was more of a popular leader, and much less of a patriot than Tiberius; the one was injured by power, but the other seems from the beginning to have aimed at little else. The elder brother was head of a party which owed its life to his principles as a politician. The younger took the lead in that party when it had been regularly formed, and in his eagerness to obtain that post regulated his conduct by its wishes. The death of Tiberius may be justly called a murder; that of Caius, or that which he would have suffered had not the slave prevented it, was nothing more than an execution under martial law.

Plutarch, Appius, and Paterculus, with what can be gleaned from Cicero and the epitomes of Livy's lost books, are nearly all the authorities for the lives of the Gracchi. We cannot refer our readers to a better modern account of the whole history of the times than that by Dr. Arnold in the *Encyclopedia Metropolitana*, and to it we are in great measure indebted for the foregoing sketch.

GRACE, DAYS OF. [BILL OF EXCHANGE.]

GRACE. This word is frequently used in the Scriptures to denote in general the favour and love of God towards mankind, and also more particularly as manifested in the gift of his son Jesus Christ. It is also employed by theologians who believe in the depravity of human nature to designate that degree of divine influence upon the mind which enables an individual to believe in the Gospel. Grace in this sense is supposed by some theologians to be given to all men to whom the Gospel has been proclaimed: while others maintain that there are two kinds of grace, which they designate as *common* and *special;* the former consisting in such divine influences as operate beneficially upon the moral character, but leave the mind without real faith; the latter, which is necessary for salvation, being granted only to such individuals as have been elected to everlasting life. [ELECTION.] There is also great difference of opinion among theologians on what is called *irresistible grace*, many considering 'that grace may be resisted and rendered ineffectual by the perverse will of obstinate sinners' (Watson's *Theolog. Dict.*, art. 'Arminius'), while others believe that it is never on the whole finally rejected, so as to fail working faith in those who are the happy subjects of it.' Doddridge's *Lectures*, Lect. 177.)

(Gill's *Body of Divinity*, vol. i.; Whitby *on the Five Points;* Doddridge's *Lectures*, Lect. 175-178.)

GRACES, GRATIÆ, or CHARITIES, in antient mythology are represented as three young and handsome sisters, the attendants of Venus. Their names were Aglaia, Euphrosyne, and Thalia. The Lacedæmonians had only two, whom they called Kleta or Klyta, and Phaënne, and a temple in honour of them existed in the time of Pausanias between Sparta and Amyclæ (iii. 18; ix. 35). Some poets name Pasithea as one of the Graces. The idea of the Graces was, according to some, originally a symbolic personification: Aglaia represented the harmony and splendour of the creation, Euphrosyne represented cheerfulness and mirth, and Thalia feasts and dances. In short, they were an æsthetic conception of all that which is beautiful and attractive in the physical as well as in the social world. Some called them the daughters of Bacchus and Venus, others of Jupiter and Eurynome. Their worship is said to have originated in Bœotia. They were originally represented as clothed, but in latter times the sculptors made them entirely naked. They were invoked to preside at the festive board, at nuptials, at births, &c. Their images were multiplied on an infinite number of sculptures and paintings, and votive inscriptions were affixed to them. Groups of the three Graces have been found, forming one of the most pleasing representations of antient art; and modern sculptors, Canova among the rest, have rivalled the antients in reproducing the same subject. (Millin, *Galérie Mythologique.*)

GRACIAS A' DIOS. [CENTRAL AMERICA, p. 419.]

GRACIO'SA, one of the Azores or Western Islands, lying near 39° N. lat. and 28° W. long, is only 20 miles in circumference: its population amounts to 7500 souls. Like the other islands of that group, it consists of volcanic rocks. It is fertile and well cultivated, and produces wine, maize, wheat, and fruits in abundance. At its north-western extremity is a small town, Santa Cruz, which has an open and dangerous roadstead; and accordingly that portion of the produce which is not consumed in the island is carried in boats to Praya in the island of Terceira, whence it is exported. There is no wood on this island. (*History of the Azores or Western Islands.*)

GRA'CULA. [STURNIDÆ.]

GRADUATE. [ARTS, DEGREES IN.]

GRADUATION is the name commonly applied to the art of dividing mathematical and astronomical instruments. The nature of this work will not admit of a detailed account of the various methods and machines used in different branches of the art; we shall only give an outline of the different processes, with references to the standard authorities, and add a few suggestions for the consideration of the astronomer and artist.

Graduation, or, as the workmen more generally style it, *dividing*, is performed in two ways, by making a *copy* of a system of divisions already existing, or by *original* dividing. The straight scales and rules which are in common use are divided thus:—The original pattern, and the scale on which the copy is to be laid, are placed side by side; a straight edge, with a shoulder at right angles, like a carpenter's square, is made to slide along the original, stopping at each division, when a corresponding stroke is cut by the dividing knife on the copy. With care and practice, this method admits of considerable accuracy. By making the straight edge turn on the centre of a divided circle, the divisions of that circle may be copied upon any concentric circle. Common protractors are thus divided, and scales upon circular limbs. The original circle, which may have several orders of divisions for different purposes, is called a *dividing plate*.

The above method requires a *standard*, which must be divided *originally*. This will be noticed hereafter.

Small theodolites and ordinary circular instruments must have been thus divided, previous to the invention by Ramsden of his *dividing engine*. The errors were of course large, and Mayer proposed to get rid of them by his principle of *repetition* [REPEATING CIRCLE]; but Ramsden's discovery of a machine for rapid and accurate dividing was better adapted to ordinary purposes. The general principle of Ramsden's dividing machine may perhaps be understood by the following description:—A horizontal circle of four feet diameter turns upon a vertical axis; the outer edge is ratched, or notched, by an endless screw, one revolution of which carries the circle round 10′; the pressure of the foot upon a treadle turns the screw forward, and there is a series of very ingenious contrivances which enable the divider to turn the screw through any portion of its revolution at each descent of the treadle, and which restore the position of the parts, when the foot is taken off, without allowing any return motion to the screw. The circle to be divided is fixed upon the dividing engine, and made concentric with it, and a division cut after each pressure of the foot. The Board of Longitude gave Ramsden a reward of 300*l.* for the invention of this machine, and 315*l.* for the machine itself, leaving it, during pleasure, in his possession, on condition that he would divide sextants at six and octants at three shillings, for other mathematical instrument makers. Machines of a similar kind, with some alterations and improvements, have since been constructed by John Troughton, Edward Troughton, and others, and these are still employed in all instruments which are not large enough, or not sufficiently valuable, to require original dividing.

Ramsden invented a machine for dividing straight lines, in which he used a screw as his original. In the form proposed by Ramsden the machine has not been deemed of any value, since a long screw can never be made so accurate as a scale divided by bisections. Mr. Bryan Donkin has contrived a machine where a screw is indeed the scale, but where the errors of the screw are corrected by additional mechanism. We do not think that this machine has ever been figured or described, but scales have been divided, and screws cut by it of extraordinary accuracy.

Dividing engines have been constructed somewhat differently by Reichenbach and others in Germany, and by Gambey in Paris. Much of the German division is excellent, and probably superior to any English engine-dividing. It is understood to be performed by copying. A large circle having been divided originally with great care, the copy is placed upon it, and concentric with it. A microscope is fixed independently over the divided circle, the divisions are brought in succession under the wires of the micrometer, and a line is cut in the copy after each bisection. This process is much more tedious than the English engine-dividing, but it admits of the greatest accuracy when the workman is careful and expert. It is a defect in the English engine that the circle to be divided must be detached from its centre and framing, and that when reframed there is frequently a sensible excentricity, *i. e.* the centre of the divided circle is not in the axis of rotation. This does not however cause any error if two or more opposite readings be used. It is a worse fault, that if the instrument be badly framed the circle may become distorted when the instrument is again put together. But when the divided limb is only a part of a circle, as in the sextant, any error of excentricity is of serious importance, and this error may be very sensible after the utmost care of the artist. [SEXTANT.] Gambey has constructed a dividing engine, by which the instrument is divided upon its own centre, but we cannot here describe the contrivance, and are not aware that it has been published.

It has not, we believe, been ascertained what average amount of error is to be feared in an English circle, engine-divided. We have not been able to learn a more important point, whether circles from the same engine are facsimiles. If they are, it would be easy to determine the error of one copy, and to apply correcting pieces to the stop of the dividing screw. This point is worth the attention of the artist, for if the engine does always give the same result, the correction would neither be troublesome nor expensive; and if it does not, nor can be made so to do, the German mode of copying must be followed where great accuracy is necessary.

In what has preceded, the existence of a standard is presumed; we will now give a brief and very imperfect sketch of the art of *original* dividing. Before the invention of the telescope, almost any mode of division must have been sufficiently accurate. In a circle of three feet radius, 1′ is rather more than 0·01 inches, a quantity the half or third of which is readily seen and still more easily felt, so that the observations of Tycho and Hevelius might very well have been exact to 10″ if their greatest errors had arisen from the erroneous division of their instruments. The earliest essays in dividing which we are aware of are those of Hooke and Roemer. Hooke proposed to cut the edge of his quadrant by an endless screw, just as in Ramsden's engine, and to use the revolutions and parts of the screw as a division. This was done in Flamsteed's sector, constructed by Tompion, probably under Hooke's control, and also in his mural arc, but both the limbs were also divided into degrees by diagonal lines, &c.; and in the 'Historia Celestis' the revolutions and parts of the screw are set down, as well as the divisions. It is found in practice that such a mode of dividing is liable to very considerable errors unless checked and corrected by independent divisions. Roemer, when he had constructed his transit-circle, directed his pupil Horrebow to describe a number of concentric circles on the limb, very near each other, and then to divide them into equal parts by *stepping* along each with a pair of compasses opened to a space of about 10′. All that he required was to have the dots round and the spaces equal; the actual value of each space was to be ascertained by finding how many were contained in the arc of 90°, *between the pole and the equator*. Horrebow informs us that only one of these series of divisions was executed which turned out exact enough to satisfy Roemer. The objection to this division is the same as to Hooke's endless screw, that there is no check upon an accumulation of small errors; still it is probable that Roemer's circle was the best divided instrument then in existence, and the idea of determining the value of the parts by observation is worthy of its author. We have no account of the way in which either Flamsteed's sector or his mural arc was divided. All we know is that the latter instrument was divided by the 'skilful hand of Abraham Sharp,' then Flamsteed's assistant.

The art of dividing assumed a new form under the celebrated Graham, the father of all good clock, watch, and instrument making in this country, and the worthy associate of Bradley. He pointed out the fundamental principle of original graduation, that you can divide a given line accurately into two parts, but not into three or five equal parts. The dividing tool employed by Graham was the beam-compass, a straight rod of wood or metal, on which perpendicular points of steel are fixed. Now if a line or arc is to be bisected, the points of the beam-compass are placed *nearly* at the distance of half the line, or the chord of half the arc between the dots. One point is placed in one dot, and a faint arc is struck with the other point towards the distant dot, and this operation is repeated with the second dot as a centre. The two faint arcs will either include a small space, or leave a small space between them,

which can be most accurately divided with a pointer by the hand, aided by a magnifying lens. In the mural quadrant which Graham erected at Greenwich, he carried this principle into full operation. The beam-compass, which was used for drawing the divisional arc of the quadrant, was used for setting off the chord of 60°; this was bisected, and the radius being again set forward from 30°, he had the quadrant exact. The arc of 60° was divided by continual bisections into 64 (or 2^6) equal parts, and the arc of 30° in like manner into 32 (or 2^5) parts. The subdivisions were, on the same principle, into 16 parts each. This division of the quadrant into 96 parts was continued as long as quadrants remained in use, but the trouble of reducing every observation into ordinary degrees, minutes, and seconds, was a considerable increase of labour to the observer. The quadrants were generally divided into 90 as well as into 96 parts, and in Bradley's and Maskelyne's 'Greenwich Observations,' the zenith distances are recorded in both divisions, with a recommendation to trust to the 96 division in cases of discrepancy. The improvements introduced by Bird chiefly apply to the division into 90°. He made a long scale of equal parts by stepping three times with a beam compass 51·2 inches, and subdivided each of these parts by continual bisections into tenths. For further subdivision, a space of 25,856 inches was taken, and divided into 256 parts by perpetual bisection; hence, as each of the new spaces was 0·101 inches, he had, with his vernier, a scale of equal parts to 0·001 of an inch. From such a scale of equal parts as this and the proper tables, all the lines of Gunter's and other scales are laid off upon a standard. In dividing the mural quadrant Bird made great use of his scale, chiefly to obtain the arc of 85° 20′, which admits of perpetual bisection, being 1024 × 5′. The chords of the several arcs were computed and beam-compasses prepared, which were adjusted by the scale to be the chords of 30°, of 15°, of 10° 20′, and of 4° 40′, to the proposed radius. The scale, quadrant, and beam-compasses were then left all night to come to the same temperature, and before sunrise were examined, and readjusted if incorrect. The arc being struck, the radius marked off the chord of 60°, which was bisected with the beam-compass containing the chord of 30°, and the radius protracted from 30° gave the quadrantal arc exactly as in Graham's mode of dividing. The arc between 60 and 90 was then bisected in 75° by its proper beam-compass, the chord of 15°, and then the chord of 10° 20′ was carried forward from 75°, and the chord of 4° 40′ was carried backwards from 90°. The exact joining of these two chords in the same point proved the accuracy of the operation. The fifth beam-compass had been set to the chord of 42° 40′, and with this the arc of 85° 20′ was bisected. When this part had been subdivided, the chord of 64 subdivisions, or of 5° 20′, was taken from the divided portion and carried forward from 85° 20′, and then perpetually bisected. Bird remarks 'that the points at 30°, 60°, 75°, and 90° fell in without any sensible inequality.' Bird's manual skill and the great care he took to avoid errors arising from the partial expansion of the quadrant or tools during the operation gained him great and merited reputation, but we are inclined to doubt whether in engineering or theoretical accuracy of division he made any step beyond Graham. The careful division into 90° is a retrograde step.

The divisions of Graham, Bird, Ramsden, and the elder Troughton, were all performed by the beam-compass, and in a great measure by touch: magnifying lenses were indeed applied to the points of the beam-compasses, but when an erroneous point is once made, the beam-compass naturally falls into it, and there is considerable trouble in rectifying the error. A French nobleman, the Duc de Chaulnes, after perfecting the micrometer microscope for reading off the divisions of astronomical instruments [CIRCLE], first showed how it might be used in actual dividing. He did not however follow Graham's rule and proceed by perpetual bisections; hence his method was neglected, although Ramsden saw the advantage of the micrometer microscope, and used it for reading off the divisions of his circles and theodolites. In this state the art was taken up by Edward Troughton, who by a happy combination of the principle of Graham, the Duc de Chaulnes' mode of reading off, and his own ingenuity, brought the division of astronomical instruments to its present state of perfection. We will suppose that a circle is to be divided originally. After the edge of the circle is very carefully turned upon its own centre, a small circular roller, 16 revolutions of which carry it exactly round the circle, is prepared and so fitted to the circle by a radial frame joining the two centres, that on turning the frame round the roller is also turned in an opposite direction by friction between the edges of the roller and circle. The roller is divided into 16 parts, and a microscope placed over the divisions, and as each division comes under the microscope, a fine round dot is marked upon the circle, which thus receives an approximate division into 256 (or 2^8) equal parts. Troughton expected that as the roller could be carried round the circle any number of times without over or under lapping, it would also mark out equal portions at each revolution, but he found himself mistaken, and he therefore proceeded to examine the dots optically. Two microscopes A and B are fixed above the circle, nearly in a diameter, and the dots which are to determine the divisions 0° and 180° are bisected by them. The circle is then turned half round, and dot 180° brought under A; if 0° at the same time falls exactly under B, the points are diametrically opposite, if not, the quantity and direction of the error is measured by the micrometer of B, half of which is evidently the error of dot 180°. The microscope B is then shifted and fixed over dot 90°, while A bisects 0°. By a quarter revolution of the circle 90° is brought under A, and 180° under B, and the error, if any, measured and noted. In like manner the error of dot 270° is detected, after which the microscope B is again shifted, and fixed over dot 45°, when the errors of dots 45°, 135°, 225°, and 315°, are determined. It is easily seen that this is exactly Graham's principle of perpetual bisection, only using an *optical* beam-compass instead of one with points, and *registering* the errors of the dots instead of cutting actual divisions. In this way Troughton proceeded by continual bisections to note the relative or apparent errors of the 256 dots. His next step was to compute the actual or true error of each dot, and to form a table. Suppose that in examining the 180° dot, he found that the arc from 0° to 180° was less than the arc from 180° to 360° by 20″, he would conclude that the dot 180° was 10″ behind its true place. Again, let the arc from dot 0° to dot 90° exceed the arc from dot 90° to dot 180° by 30″. If 180° were right, 90° would be too forward by 15″; but as 180° is 10″ behind its true place, 90° will on this account alone be 5″ behind, and therefore on the whole will be 10″ too forward.* The true errors of each of the 256 dots being thus computed, Troughton returned to the roller, and by help of a small sector which revolved with it and gave him an enlarged scale, enabling him at the same time to reduce the division into 256 parts into 360° mechanically, proceeded to cut the actual divisions on the circle. This method was communicated to the Royal Society, and printed in the 'Phil. Trans. for 1809,' p. 105. The Copley medal was granted for this very valuable and original memoir. Several circles have since been divided after Troughton's method, by his successor Mr. Simms, and by Mr. Thomas Jones, and it has been thus proved that the merit of Troughton's dividing depended, as he asserted, on the excellence of his processes, and not on his manual dexterity. It is not worth while to divide a circle *originally* which is less than two feet in diameter.

There is a caution with respect to this mode of dividing which will be sufficiently obvious when pointed out, viz. that very great care indeed must be taken that the pivots on which the circle turns shall be perfectly true and round. The circular line to be divided, and the rim on which the roller moves, are respectively drawn and turned from these pivots, and the figure of neither is a circle unless the pivots be so. The large collar of the mural circle on which the rim is turned is of steel, and several inches in diameter. It often happens that hard knots occur in the steel which ordinary tools will not touch, and it would be prudent in the artist to perform the finishing part himself with a diamond.

We should also recommend the following extension of Troughton's mode of examining his primary dots. After

* Let ϵ and ϵ' be the errors of any two dots, a and b, + when too forward, and − when behind their true place, and the distance to the bisecting dot c be from $a = m$ and from $b = m + k$: then the apparent error of c is $-\frac{k}{2}$; for it should be at a distance $m + \frac{k}{2}$ from a. But the dot a is wrong ϵ, and the dot b is wrong ϵ'; therefore there is a further correction of $-\frac{\epsilon+\epsilon'}{2}$, and the whole error of c is (attention being paid to the signs) $-\frac{\epsilon+\epsilon'}{2} \quad \frac{k}{2}$; from which expression the mode of forming the table of real errors is very evident, care being taken not to confound the signs, and also to pass from the arcs to the half arcs in succession.

determining the errors of dots 0° and 180°, we should leave the microscopes A and B undisturbed, and fix two new microscopes, C and D, at 90° and 270°. Then having adjusted C and D in 90° and 270°, and having ascertained their errors, as has been already described, the circle should be turned round till 0° and 180° are bisected by B and A, when 90° is under D, and 270° under C. The errors are then to be again determined exactly as before. Now, if the circle turn round a mathematical point, the two results must of course be identical; but if not, it may happen that the observations will give two errors for dot 90° and two for dot 270°, which should however have the same difference. The final error, or that which the artist should adopt, for each dot, is the *mean* of the two determinations, which will give the position of a line at right angles to the diameter from 0° to 180°, and the nearest possible to the variable centre. It is also clear when this discrepancy is found that the centre has not been properly turned. By extending the above process to the dots which bisect the quadrants, *i. e.* shifting the microscopes C and D to 45° and 225°, and trying the dots, as in Troughton's method, and also after a half-revolution, a series of bisecting diameters may be found which will cut the diameters already determined at angles of 45°, and pass as near the variable centre as may be. This process should be continued one or two steps more, and then Troughton's method may be considered sufficient for the rest. If the above system of examination should appear too troublesome, it would be at least advisable, when Troughton's subdivision has been carried to 16 or 32 parts, that the table of true errors should be checked by opposite readings. This is easily done by bringing each dot in its turn under microscope A, and reading off the apparent error of the opposite dot by microscope B. As the true error of the dot under A is known from the table of errors, this, + the apparent error as shown by B, should = the true error of the dot under B, which is also known from the table of errors. Any sensible discrepancy in these two values will show a faultiness in the centre. Again, if the artist have, as he ought to have, a convenient pier and a sufficiency of micrometer microscopes, he may ascertain the errors of his four or eight primary dots, by placing four or eight equidistant microscopes round his circle, and reading off at each quarter or one-eighth of a revolution. It would be prudent to repeat this several times and on several days, selecting the times when the temperature had been and promised to be steady. This principle might be carried on farther in examining a graduated circle by changing the number of microscopes. Indeed, if the centre were very irregular, and therefore the curve traced out by its revolution, a better division into equal parts might be got after a preliminary division by *stepping* than by Troughton's method unaltered. As the + and − signs used in forming the tables of apparent and true errors may cause a little confusion, it is usual to cut a few slight divisions, which may easily be rubbed out, and thus to *test* the accuracy of the table of errors before commencing the actual division.

It is easy to see how Bird's method of dividing a scale may be pursued, adopting microscopes instead of the beam-compass. The examination of such a scale is completely exemplified in Mr. Baily's memoir referred to in the sequel.

It may be useful, before we give a list of references for the history and practice of graduation, to point out the effect of excentricity in engine-divided circles, which is almost always mistaken for bad dividing by unskilful persons. If the centre of the divided circle is not concentric with the axis of rotation (we here suppose the circle to revolve, and the verniers or microscopes to be fixed), it is clear that the centre of the divisions will describe a very small circle about the axis. Now, suppose we set out from the position when the centre of the divisions is in a line with and between the axis and the reading apparatus. On turning the circle a little round, it will be seen that the angle through which the instrument *really* moves is less than the angle read off at that vernier or microscope; and on drawing the figure it will be seen that the angle read off is the exterior angle of a triangle of which the true angle is the interior and opposite; and also that the error or the difference between these two angles is the other interior angle of the triangle, the measuring arc of which to the same radius is, as to sense, equal to a perpendicular from the centre of divisions on the primary line.* Hence the error caused in any vernier by *excentricity* is an arc equal to the distance between the two centres × sine of the angle from the position we have set out from. From this consideration it will be evident to one who knows the nature of trigonometrical lines, that two, three, or any number of equidistant readings will cure excentricity, as the + errors must always equal the − errors. Now, if the possessor of a circular instrument having two or more equidistant readings wishes to examine the divisions, he may get rid of the effect of excentricity thus:—Take the mean of the readings at every 10°, 20°, or 30°, and subtract each reading from the mean. It will be seen whether the differences thus obtained can be represented under the form of a constant quantity $+ x'' \times \sin. \theta$, where θ is reckoned from some definite point. If they can, there is no error of division, and the residual quantities, when the above equation has been satisfied in the best practicable manner, will give some insight into the quality of the divisions. The error which arises from the original circular form changing to an ellipse by a fall or other injury is of the form $y'' \times \sin. 2\phi$, where ϕ is the angle from some definite point of the divisions. Hence two readings at right angles, or three equidistant readings, will compensate each other; so that three or more equidistant readings will destroy the effect of both excentricity and ellipticity. In like manner the effect of any error which obeys a law may be investigated, when the law is known, and also the number of microscopes. Hitherto four or six microscopes seem to have made every circle a well divided one.

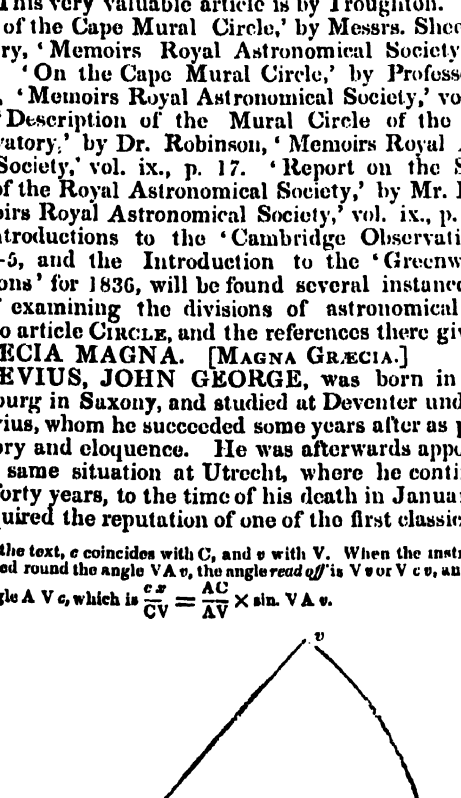
The mode of reading the parts of larger divisions has been partly explained in the description of the microscope, article CIRCLE [ASTRONOMICAL], and will be finished under the head VERNIER.

The principal sources of information on this subject are: 'The Method of dividing Astronomical Instruments,' by Mr. John Bird. London, 1767. 'Nouvelle Méthode pour diviser les Instruments de Mathématique et d'Astronomie,' par M. le Duc de Chaulnes, 1768. 'Description of an Engine for dividing Mathematical Instruments,' by Mr. J. Ramsden. London, 1777. Troughton's Memoir, 'Phil. Trans.,' 1809, p. 105. Graduation, 'Edinburgh Cyclopædia.' This very valuable article is by Troughton. 'On the Errors of the Cape Mural Circle,' by Messrs. Sheepshanks and Airy, 'Memoirs Royal Astronomical Society,' vol. v., p. 325. 'On the Cape Mural Circle,' by Professor Henderson, 'Memoirs Royal Astronomical Society,' vol. viii., p. 141. 'Description of the Mural Circle of the Armagh Observatory,' by Dr. Robinson, 'Memoirs Royal Astronomical Society,' vol. ix., p. 17. 'Report on the Standard Scale of the Royal Astronomical Society,' by Mr. F. Baily, 'Memoirs Royal Astronomical Society,' vol. ix., p. 35. In the Introductions to the 'Cambridge Observations' for 1833-4-5, and the Introduction to the 'Greenwich Observations' for 1836, will be found several instances of the way of examining the divisions of astronomical circles. See also article CIRCLE, and the references there given.

GRÆCIA MAGNA. [MAGNA GRÆCIA.]

GRÆVIUS, JOHN GEORGE, was born in 1632, at Naumburg in Saxony, and studied at Deventer under J. F. Gronovius, whom he succeeded some years after as professor of history and eloquence. He was afterwards appointed to fill the same situation at Utrecht, where he continued for above forty years, to the time of his death in January, 1703. He acquired the reputation of one of the first classical scho-

* Let A be the axis of rotation, C c the circle described by the centre of the divided circle V v, V the place of the reading. In the position first mentioned in the text, c coincides with C, and v with V. When the instrument has been moved round the angle V A v, the angle *read off* is V v or V c v, and the error is the angle A V c, which is $\frac{c\,x}{CV} = \frac{AC}{AV} \times \sin.\ VA\,v$.



lars of his age, a reputation which he supported by the numerous editions of antient classical writers which he published and enriched with his own notes, such as Catullus, Tibullus, and Propertius, Cæsar's 'Commentaries,' the 'Epistles' and 'Offices' of Cicero, Suetonius, Lucian, Hesiod, and Callimachus, besides editions of modern works on classical literature, such as Meursius 'De Regno Laconico, de Piræo, de Cypro, Rhodo, et Creta,' &c. He also published 'Inscriptiones Antiquæ totius Orbis Romani in absolutissimum corpus redactæ.' But the greatest work of Grævius is his 'Thesaurus Antiquitatum Romanarum,' 12 vols. fol., Leyden, 1694-99, in which he has collected the best writers who have illustrated the institutions and laws, the customs, the manners, and the arts of the antient Romans. He afterwards prepared, as a sequel to it, an enormous collection under the title of 'Thesaurus Antiquitatum et Historiarum Italiæ, Neapolis, Siciliæ, Sardiniæ, Corsicæ, aliarumque Insularum adjacentium,' which was published after his death by Peter Burmann, with additions, in 45 vols. fol., Leyden, 1704-25. Grævius published also a collection of rare and choice treatises, by various writers, on curious subjects connected with antient history, such as T. Reinesius 'De Lingua Punica,' and 'De Deo Endovellico,' by the same; C. Daumius 'De Causis Amissarum Latinæ Linguæ Radicum;' C. F. Frankenstein 'De Ærario Populi Romani,' &c. This collection is entitled 'Syntagma Variarum Dissertationum,' 4to., Utrecht, 1702. T. A Fabricius published a collection of Latin letters and orations of Grævius, with his éloge, by P. Burmann.

GRAFTING is an operation by which a portion of one individual of the vegetable kingdom is applied to another which is within certain limits of physiological affinity, so as to form a vital union, and consequently produce a reciprocal growth. Thus a species bearing small and austere fruit may be cut down, and the remaining part grafted with a scion from a tree of which the fruit is large and delicious; and being nourished, but not changed in any essential character, this scion will form a tree, ultimately producing fruit similar in every respect, all other circumstances being the same, to that of the tree from which it was taken. The shoots of any particular variety may be cut into many hundred pieces, if sufficiently numerous, and, by grafting, each of them can be made to possess all the properties of an individual tree in the course of one season. In the case of cultivated fruits, as well as in many varieties of ornamental plants, multiplication by seeds is precarious; and with regard to *hybrids* it is impracticable, at least no assurance can be had of a reproduction of the same variety; on the contrary, a disposition is generally manifested to return to the natural wild state of the species. Grafting is in some instances the only means, and in many it is the most eligible, of preventing this. By it the peculiar richness of the fruit or the delicate tint of the flower which we especially prefer and admire can be perpetuated in an almost infinite series of individuals, each being the result of augmentation of the comparatively small original portion—this portion being placed in favourable circumstances for receiving an abundant supply of new and proper matter, on which it exercises its organizing powers, and effects a perfect assimilation, which causes a similar development of leaves, flowers, and fruit. Again, this newly-formed augmentation being every way similar to that from which it was derived, it will continue to exercise the same functions with regard to such new matter as comes within the extending scope of its organizing powers, the progress only becoming arrested by such causes as naturally limit the growth of the parent tree. Propagation by cuttings, it is true, will equally continue the variety unchanged; but that process in numerous instances is slow: in others success is not attainable to any considerable extent.

From what has been stated, the great importance and utility of the process about to be explained will be sufficiently evident.

The limits within which grafting may be effected extend to species and varieties of the same genus, or at all events are confined within the same natural order. Hence the statements of the antients having successfully grafted the olive on the fig, plums on pears, and the like, are not to be credited. Modern physiologists explain to us that such incongruities cannot take place, and repeated experiments have proved their assertions to be correct. The Romans understood and practised the art of grafting; but it is evident that they were in a great measure ignorant of its principles, for Pliny mentions some apples in his time so red that they resembled blood; and the reason he assigns is their having been at first grafted on a mulberry stock! Tricks are so common in grafting, that Thouin, who wrote a treatise upon the subject, calls one the rogue's graft (greffe des charlatans): this is not at all uncommon in Italy at the present day, and is one of the means by which the needy but clever Italian succeeds in enriching himself at the expense of the wealthy and dull-witted Northman. In a state of nature a birch has been seen growing out of a cherry-tree; but on inspection it was easy to perceive that a seed of the birch had vegetated in a crevice, communicating with the decayed centre of the cherry-tree, among the vegetable mould of which the birch seed had taken root. The Italian, by a similar process, makes an olive, a jasmine, a rose, and a pomegranate, all *seem* to grow in harmony upon an orange. Scions, it may be observed, will often exist for a short time on stocks far removed from natural alliance; but such unions are never permanent, but merely subsist for a time, as they would if the ends of the scions were inserted into the moist substance of a potato.

Pears may be grafted, not only on other pears, but also on the quince (which is very frequently done), and on the medlar, white thorn, or mountain ash. Peaches are budded either on the almond, or more frequently on the plum, their own roots not being suited to the cold soil of this country. In these cases, although the leaves and fruit of the peach and the plum, the pear and the mountain ash, have a very different appearance, yet botanists have determined that the stock and the scion belong to the same natural order.

Having mentioned that one species is often grafted on another of a different genus, it becomes necessary to state the reason why such is in many cases more proper than on species of the same genus; and this leads to the consideration of the effects generally produced by the stock upon the graft. When the stock is of slower growth than the graft, as in the case of the white thorn and quince stocks and the pear, the consequence is a partial obstruction of the flow of the sap, which checks the over-luxuriance of the pear-tree, and its natural disposition to produce only wood for a number of years of its youth; the juices, rendered less abundant, become more inspissated, and fruitfulness is induced at an earlier age. This condition may be even carried too far; for the common quince increases so slowly in diameter compared with the generality of pears, that its vessels become inadequate for a sufficient supply of nourishment. The French, aware of this, employ the Portugal quince as a stock for their pears, because its wood increases more in accordance with that of the latter. On the same principle (that is to say, a less copious supply of nourishment) trees are rendered more dwarf than they naturally are, and hence are better adapted for small spaces. On the contrary, a weak species will have a tendency to grow stronger if grafted on one naturally more vigorous. These are modifications induced by the stock on the graft extremely necessary to be known and attended to: for instance, apple-trees on crab-stocks, if injudiciously planted in a small garden, will soon overgrow their limits; whereas on the French paradise stock, the dwarfest of any, they are easily managed within a very small space; besides, the roots of the latter are very fibrous, and run near the surface, which renders them eligible for planting over a bad subsoil. Many species and varieties both of fruits and ornamental plants, natives of a warmer soil, are advantageously grafted on their hardier congeners, such as the peach and apricot on the plum, Chinese tender roses on the wild roses of our hedges, and many ornamental species of Cratægus on the C. Oxyacantha.

The methods of grafting are of great variety. M. Thouin (*Monographie des Greffes*) has enumerated 43 modes of grafting, 39 of inarching, and 28 of budding. Many of these are however more curious than useful; and not worth being detailed. It will be better to explain the principle on which all modes of successful practice must depend, either as regards grafting, budding, or inarching.

It is well known that the bud of a plant has the power of becoming a distinct individual, if separated from the parent and placed in circumstances sufficiently favourable for its future development. But no development can take place unless the portion abstracted from any plant contain either a bud, or the perfectly formed rudiments of one. Hence the portion intended to be propagated must contain a bud or buds. The diametrical increase of exogenous

plants proceeds outwardly, in consequence of the formation of new layers of alburnum, interwoven into the peculiar texture of the tree by extensions of the medullary rays. The alburnum is interposed between the inner bark and the heartwood, with both of which it is in vital or organized union. The greater part of the heartwood of a tree may be bored out, and, though made a hollow cylinder, it will still continue to increase. The outer bark may be removed, and a new one will gradually be formed; but, if the alburnum be entirely destroyed, death will be the consequence.

It appears therefore that buds with some portion of alburnum are the parts essentially necessary for propagation; for although the heartwood and bark be organized, yet they are but passively so, and have not the power of extending organization to new matter when they are deprived of the media of buds and alburnum. Keeping therefore the importance of the latter in view, the best mode of operation is that whereby the greatest possible extent of the alburnum of the stock and graft is brought into exact contact, without making too extensive a wound. If the sections of alburnum can be made to coincide in every point, the result of the operation will be the most perfect that can be obtained.

The modes of grafting most generally practised are, whip, cleft, saddle, and crown grafting. Of these *whip-grafting* is by far the commonest, and is performed as follows:—the stock is cut over, sloping, above a smooth and straight part. The end of the scion is cut sloping and thin towards the lower end. Then on the same side of the stock as that of the lowest part of the slope made in cutting off its top, a slice is cut clean off, in length equal to that of the cut part of the scion, and in breadth so as to expose as much of the wood of the stock as will equal that seen in the slanting section of the scion. Both sections should be smooth and plain, and as regards the alburnum, they should be the exact counterparts of each other; or, if this cannot generally be the case, the coincidence should be as exact as can be on one side at least. A thin wedge-shaped tongue is made very near the upper part of the slope in the scion, and a corresponding nick in the stock to receive it. The top part of the scion is shortened to two or at most three buds, and fitted to the stock, to which it is tied with a strip of pliable matting; and the parts so united are then covered with grafting-clay, or some other composition, which remains till the graft has pushed, or as long as there is no danger of the matting, used as a ligature, cutting or galling the parts when they begin to grow and to have an enlarged circumference. After the first loosening it is often advisable to apply slightly a fresh bandage immediately; and in some cases a little clay or composition may be put round, should the union appear too tender to endure exposure to the vicissitudes of the weather.

Cleft-grafting is performed by splitting the stock diametrically across the top, which should be cut horizontally, and then nicely inserting in one side a scion cut like a wedge. This mode is objectionable, because the deposition of young wood takes place for the most part in a projection exterior to the circumference of a circle having for its centre the axis of the stock; the top of the latter is consequently left long uncovered and becomes unsound from the wood being split to admit the graft.

Saddle-grafting is the reverse of the preceding, inasmuch as the stock, instead of the scion, is formed like a wedge; and the end of the scion made to fit over it, like a saddle. It is preferable to cleft-grafting, particularly where the stocks are small, or nearly of the same size as the scion; but when the stocks are large, it is by no means to be recommended.

Crown-grafting is performed on large limbs with thick bark, or on large stems; in either case these are cut off at right angles; the bark is raised by thrusting in a tapering flattened piece of smooth hard wood, or ivory, between the wood and bark; this being withdrawn, the end of the scion, properly thinned as if for whip-grafting, but without the tongue, is inserted. Three or four scions may with propriety be thus inserted in the same branch or stem. This method is objectionable for the following reasons:—the section of the scion is plane; the part of the stock to which it is applied is circular; consequently, these surfaces can only come into partial contact. Again the abrasion must be considerably larger than the space covered by the scion, particularly if the bark of the stock be rigid. If we compare this state with the principle laid down in the preceding part of this article, the result will be, what ample experience has proved to be the case, that even on large trees whip-grafting is preferable. In fact, the cavity on each side of the scion in crown-grafting must be filled with something; either air, which is injurious, or, if the tree be vigorous, a deluge of sap will flow to it; and it often happens that this, technically speaking, drowns the graft.

Cuttings intended for scions should be taken from the trees before the movement of the sap commences in spring, and put in moderately moist earth or sand, and out of the sun's rays. If the stocks be cut down at the same time it will be so much the better; any large limbs of trees which it may be found necessary to graft should by all means be cut in before vegetation becomes active, otherwise extravasation takes place and canker is in consequence induced.

Grafting Clay may be made from any smooth clay, or adhesive clayey yellow loam, or brick-earth, mixed with one-third, or, according to some, one-half of cow-dung, free from litter, excepting that of hay, and if it contain none of the latter, some fine hay must be beaten up with the mixture; the hay answers the same purpose as hair in plaster A mixture of clay and horse-dung is preferred by some. The fact is, that any composition will answer that will exclude the air, retain some degree of moisture, and at the same time prove not injurious to the barks of the stock and scion which it surrounds.

Grafting Wax, a compound of pitch, rosin, bees'-wax, hogs'-lard, and turpentine, has had a great reputation as a means of fixing the scion to the stock, but it is liable to two serious objections. In the first place it does not adhere and exclude air unless both stock and scion are perfectly dry when it is used; secondly, the winds in March, the general period of grafting, are excessively drying, and were it not for the moisture absorbed from the clay the scion would frequently be shrivelled, and dried up before it had time to vegetate: but resinous substances do not permit of any similar absorption of beneficial moisture.

Inarching is a species of grafting, the success of which depends on the principles above explained. It is sometimes called grafting by approach, because in performing the operation the branches or stems of two contiguously growing plants are made to approach and unite; and this union is effected on the same principles as that of whip-grafting. Corresponding slices are taken off, a small slit being made upwards in the part that is to form the head, and another correspondingly downwards in the stock; being joined, the wounded parts are tied together, and covered with moss or grafting-clay. When properly united, that which is to form the top is by degrees severed from its parent root, and thus transferred it ultimately becomes the sole ascending stem of the one to which it was made to unite.

It is generally believed that although the stock and scion are organically united by the operation of grafting, yet that no other effect follows the operation than what may arise from the slowness or quickness with which the stock allows the sap to rise upwards into the scion; and it is generally believed that the scion exercises no influence whatever upon the stock. It is however perfectly certain that a bud of a variegated jasmine, made to grow upon one branch of a large tree of a plain jasmine, will gradually give the variegated appearance to the plain stock. This was long since asserted, then denied, and has been lately proved to be true by new experiments.

GRAFTON, RICHARD, a printer in London, in the middle of the sixteenth century, under whose name are several works relating to the history of England. He is not much esteemed. Bishop Nicolson says of him that he is 'a great borrower from Hall, and was a very heedless and unskilful writer,' citing Buchanan, the Scotch historian, as being of the same opinion.

There is a small Chronicle, in 16mo., which was often reprinted between 1563 (when it first appeared) and 1572; a still smaller, in 24mo., 1565; and his great Chronicle, in two volumes, folio, 1569. The appearance of the Chronicles of Holinshed and Stowe threw Grafton's into the shade.

GRAHAM, JAMES. [MONTROSE.]

GRAHAM ISLAND, one of the names by which the volcanic island thrown up off the coast of Sicily in July, 1831, was called. It has since disappeared. [VOLCANO.]

GRAIN (*granum*, a seed), an old measure of weight, the smallest of those in use. It is of about the weight of a seed of wheat corn, and must therefore be considered rather as a theoretical aliquot part of a larger weight, than as itself a

proper standard of weight. We shall therefore refer to WEIGHTS AND MEASURES, AVERDUPOIS, TROY, &c. for further information, stating in the present article all that refers to this particular measure. The word has not only designated a weight, but a coin: Ducange mentions an antient Neapolitan piece of money called a grain, and the *grano* is still used in reckoning in Naples, Sicily, and Malta, though there are not now any coins so called.

By a statute passed in the reign of Edward III., (A. D. 1266), it was enacted that 32 grains of wheat taken out of the middle of the ear, and well dried, should weigh a pennyweight, of which 20 should make an ounce, of which 12 should make a pound. Consequently the pound (troy) of this period consisted of 7680 grains, whereas that afterwards in use had only 5760. The reason was, that it became usual to divide the same pennyweight into 24 instead of 32 grains. This must have occasioned an alteration either in the value of the pound or of the grain. The former has been sometimes stated, but we believe the latter. The value of the average grain of wheat is stated by Paucton at ·86 of the grain of the *poids de marc*, that is, at about seven-tenths of our modern English grain. But if 32 grains of real weight were made to weigh 24 grains so called, the grain of wheat would be ·75 of the weight called a grain; which comes near the preceding. It is certainly possible that the grain of French wheat may differ from that of the English; and it is also known that the weight of grain varies considerably in different harvests and under different modes of culture. This latter circumstance rather affords a presumption that it was the wheat which varied: it is not at all unlikely that improved agriculture gave wheat of which 24 grains were equivalent to 32 of the more antient harvests. According to Dr. Bernard's measurement, the grain of barley is ⅔, or ·67 of the troy grain.

However this may be, the grain must have lost much of its importance by the introduction of the averdupois pound, of which it is not a constituent aliquot part. The antient averdupois pound is variously stated at from 7009 grains to less than 7000, at which latter number it is now fixed by law.

The grain has varied considerably in different countries: Dr. Bernard mentions the Rabbinical grain, which was two-thirds of the English grain; the money grain of Venice and Paris (that of the poids de marc above noticed), which he places at ·8334 of the English grain; and the physicians' grain of the Greeks, Arabs, and Venetians, which was ·9166 of the English grain.

The weight of one grain is obtained, for practical purposes, without difficulty, by weighing a thin plate of metal of uniform thickness, and cutting out by measurement such a proportion of the whole plate as should give one grain. But a much better plan is to draw a given weight of ductile metal into very thin wire, and to cut from the wire that length which is the same proportion of the whole length as a grain is of the whole weight. In this way pieces of wire are obtained for chemical purposes which weigh only the thousandth part of a grain; and even less weights might be obtained, if it were necessary.

GRAINGER, JAMES, was born at Dunse, about the year 1723. Having been educated for a surgeon, he served in the army in that capacity, first during the rebellion of 1745, and afterwards in Germany. Having resigned his commission, he practised for a short time in London, and then accepted a situation at St. Christopher's. On his arrival there, he married the daughter of a lady whom he had cured of small-pox during the voyage. He continued, with a short exception, to reside at St. Christopher's until his death, which took place December 24, 1767.

His only claims to celebrity rest on his 'Ode to Solitude,' and his poem entitled the 'Sugar-Cane.' Of the first, we can only say that it contains sundry false quantities, much nonsense, and a few good lines; and of the second, that it is one of those numerous instances afforded, wherever we turn in the literature of the last century, which show that the principles of poetry had been utterly lost sight of by a large proportion of those who called themselves, and whom others called, poets.

Virgil has shown what difficulties didactic poetry presents; but when a man of but moderate powers of versification, and very little taste, sits down to write a treatise on sugar plantations, and thinks it an improvement on 'rats' to call them 'the whiskered vermin race,' little indeed of true poetical imagery can we expect to find amongst his descriptions. The absurdity of hanging classical trappings round a subject like our author's is too evident to need notice, and perhaps the poem is too much forgotten to make it worth while to censure its principles; but we cannot dismiss the subject without remarking that Grainger shows himself to have been almost entirely callous to the barbarities practised on the slaves.

Grainger was engaged in some controversy (the detail of which is uninteresting) with Smollett; for this, and other particulars of his life, see Chalmers' 'British Poets.' One of his poems, 'Bryan and Pereene,' a West-Indian ballad, is preserved, a straw in amber, in Percy's 'Reliques.' See Chalmers' *Life of Grainger*.

GRAINS OF PARADISE are hot, acrid, aromatic seeds, produced upon the coast of Guinea, and used for medicinal and other purposes as stomachic and cordial stimulants. They are produced by the Amomum Grana Paradisi of Linnæus, and Amomum grandiflorum of Smith.

GRAKLE. [LAMPROTORNIS.]

GRALLÆ, (WADING BIRDS,) the fourth order of the class *Aves*, according to Linnæus, and placed by him, in his last edition of the 'Systema Naturæ,' between the orders *Anseres* (the third) and *Gallinæ* (the fifth).

Linnæus thus characterizes the *Grallæ*:—*Bill* (a sounding staff, *Bacillus tentans*) subcylindrical. *Feet* wading, the thighs half naked. *Body* compressed, the skin very thin, sapid; the tail short. *Food*, consisting of animalcules, obtained in marshes. *Nest* most frequently made on the ground; sexual congress varying ('nuptiis variis'). Analogous to the *Bruta*.

The same author divides the order into two sections.

*

Feet four-toed.

Phænicopterus, Platalea, Palamedea, Mycteria, Tantalus, Ardea, Recurvirostra, Scolopax, Tringa, Fulica, Parra, Rallus, Psophia, Cancroma.

Feet cursorial, i. e. three-toed.

Hæmatopus, Charadrius, Otis, Struthio.

In the body of the work Linnæus gives the following definition of the *Grallæ*:—*Bill* subcyrindrical, rather obtuse. *Tongue* entire, fleshy. *Thighs* naked above the knees. [GRALLATORES.]

GRALLATO'RES (Illiger), the fourth order of Birds according to the system of Mr. Vigors, the *Rasores* being the third, and the *Natatores* the fifth.

Mr. Vigors considers the *Grallatores* as one of the aberrant groups of the class, and as exhibiting an equally circumscribed sphere of action as the *Rasores*. Holding an intermediate station between the *Gallinaceous* birds, which are restricted to the land, and the *Natatorial* groups, which are confined to the water, their typical groups appear to Mr. Vigors to be those which partake most equally of the advantages of both elements; and the aberrant groups those which discover a more predominant inclination to either. 'Of the five families,' continues Mr. Vigors, 'into which the order before us branches out, we may, in this point of view, pronounce those two to be most typical which inhabit the land, but derive their support from the water, or, to speak more correctly, which derive their whole support from the latter element, without possessing those powers of swimming or diving which are peculiar to the true water-fowl. The exclusive food of such groups will be fish, water reptiles and insects, mollusca, and animalcula; and their distinguishing external characters, length of legs and bill, the former for the purpose of wading, the latter for that of seizing their prey, or of extracting it by suction from the waters or marshes. Of the three remaining families, two, as I have observed in an early part of this inquiry, will be found to deviate from the more typical, in their food and manners being more terrestrial, and their general appearance and structure more conformable to that of some groups of the preceding order of *Rasores*: while the third, by its capability of swimming and the rudiments of the natatorial membrane that connects the fore-toes of some of its species, equally deserts the same type, and goes off, on the other hand, to the *Natatores*. Taking these peculiarities into consideration, we may venture to view the order according to the following arrangement, placing, as usual, the more typical families in the centre —

Gruidæ.
Ardeidæ, Leach.
Scolopacidæ.
Rallidæ, Leach.
Charadriadæ, Leach.

The following disposition distinguishes the normal and aberrant families:—

Normal Group.

Bills long, principally fitted for suction { *Ardeidæ.* *Scolopacidæ.*

Aberrant Group.

Bills short, and fitted for capturing, not sucking . . { *Rallidæ.* *Charadriadæ.* *Gruidæ.*'

The species that enter into the different families will be noticed in the articles which treat of them, as well as the mode of union between one family and another.

Mr. W. S. MacLeay, in his paper 'On the Comparative Anatomy of certain Birds of Cuba,' observes that the relations of analogy pointed out by Linnæus between Mammalia and Birds are, as Hermann has observed, not always correct; and that his errors have arisen from the misfortune of his not detecting the natural group of Aristotle and Ray, which the latter has called *Ungulata*. 'Having,' says Mr. MacLeay, 'only been able to seize Aristotle's subdivisions of Τα μεν ουκ αμφοδοντα, he lost the parallelism of analogy, and fell, as I shall hereafter show, into very glaring mistakes. In the *Systema Naturæ* however he has mentioned that very striking analogy which appears between the groups of *Grallæ* and *Bruta* [GRALLÆ]; that is, according to the parallelism of analogy, between the order of *Grallatores* and *Ungulata*, since the *Bruta*, as we have seen, do not form an order, but only a natural subdivision of the *Ungulata*. That this analogy is demonstrably true, I deduce from the following facts. Of their respective classes, the orders of *Ungulata* and *Grallatores* contain examples of the longest legs in proportion to the body,—witness *Camelopardalis* and *Hæmantopus* (Himantopus of authors?). Both orders present us, in groups not exactly aquatic, with instances of the toes being soldered together, as the Horse; or connected together with a web, as the Flamingo. Both orders present us with the greatest elongation of muzzle or facies,—witness *Myrmecophaga* [ANT-EATER], or *Antelope*, (particularly *A. Bubalus*) [ANTELOPE, vol. ii., p. 90], and *Scolopax*; and also with the most depressed form of muzzle,—witness *Hippopotamus* and *Platalea*, which genera also afford us the truest specimens of wading *Vertebrata*. In both orders we have the most elongated claws,—witness *Megalonyx* and *Parra*. Both orders afford us the swiftest animals in running,—as the Horse and *Tachydromus*; and the most pugnacious on account of love,—as the *Bull* and *Machetes*. The Bull moreover and the *Bator* (or *Bostaurus*, for hence comes the bird's name) [BITTERN], afford us the loudest and hoarsest voice of their respective orders; where we have also the most remarkable instances of the upper and under mandible touching each other merely at their base and point, as *Myrmecophaga*, or the whole of the τα μεν ουκ αμφοδοντα of Aristotle, and *Anastomus*, Illig. Both orders exhibit ornamental appendages to the head,—as the antlers of the stag and the crown of the crane; and both afford us the only instances of true horns, as *Bos*, or *Rhinoceros*, and *Palamedea*, L. To see a hundred such instances of resemblance it is only necessary to walk into a museum. I shall therefore only further say, that both orders contain polygamous animals, are generally gregarious, and more graminivorous than granivorous, being essentially inhabitants of marshes and savannahs. Thus then with Linnæus I place the *Bruta*, or rather the whole order of *Ungulata*, to which they belong, opposite to the *Grallatores*.'

Mr. MacLeay then proceeds to observe that four orders in each class being disposed of, it follows by parallelism of analogy that the *Glires* ought to be placed opposite to the *Rasores*. But, he asks, setting theory wholly aside, is this position true in fact? Linnæus, he remarks, from the above-mentioned error in his series of affinity considered the *Rasores* to be analogous to his group of *Pecora*. But this group, according to Aristotle and Ray, is only a subdivision of *Ungulata*, which have, Mr. MacLeay considers, been now proved to be analogous to the *Grallatores*. If therefore, he concludes, Linnæus be right in making his *Bruta* analogous to the order of Wading birds, it follows that his *Pecora* must be so also.

In the same paper therefore Mr. MacLeay gives the following tables of analogies between the *Mammalia* and *Aves*:—

	Animals typically	
1. FERÆ	carnivorous. . .	1. RAPTORES.
2. PRIMATES . . .	omnivorous. . .	2. INSESSORES.
3. GLIRES	frugivorous. . .	3. RASORES.
4. UNGULATA	frequenting the vicinity of water.	4. GRALLATORES
5. CETACEA . .	aquatic. . . .	5. NATATORES.

SCANSORES.		INSESSORES.		AVES.
PSITTACIDÆ	representing the	DENTIROSTRES,	and therefore the	RAPTORES.
RHAMPHASTIDÆ	joining the	CONIROSTRES,	and forming part of the	INSESSORES.
CUCULIDÆ	forming part of the	SCANSORES,	and joining the	RASORES.
CERTHIADÆ	joining the	TENUIROSTRES,	and representing the	GRALLATORES
PICIDÆ	representing the	FISSIROSTRES,	and therefore the	NATATORES.

The latter table, Mr. MacLeay observes, will express several analogical relations of the utmost value, and the reader will find them fully explained in Mr. MacLeay's memoir. (*Linn. Trans.*, vol. xvi., p. 1.)

Mr. Swainson (*Classification of Birds*, vol. i.) remarks, that the grallatorial or tenuirostral type is shown in birds, as in quadrupeds, by a great slenderness and elongation of the jaws, muzzle, or bill—for all these, he states, are merely different terms to express nearly the same thing; 'the notch in the bill, when it exists, is very slight, and the feathers of the front are considerably advanced upon the base of the upper mandible. The opening of the nostrils is very long, often tumid, but never round. Great swiftness either of foot or of wing is a constant indication of this type. Sometimes, as in the Snipes, both these characters are united; at other times, as we see in the Humming-birds, this swiftness is confined only to flight; while in some few, as in the Flamingo, the wings are short, but the feet very long. The aperture or gape of the mouth is generally very small, .. in all suctorial animals,—witness the whole of the typical *Grallatores* or waders, and their representatives the *Trochilidæ*. The smallest birds, no less than the smallest quadrupeds, are of this type, which is again represented by the little gliriform *Mammalia*.'

Mr. Swainson gives, in the same volume, the following table of analogies:—

Primary Types.	Orders of Birds.	Typical Characters.	Orders of Quadrupeds.
1. Typical	INSESSORES	Organs of prehension and general structure highly developed.	QUADRUMANA.
2. Sub-typical	RAPTORES	Carnivorous; claws retractile.	FERÆ.
3. Aquatic	NATATORES	Live and feed in the water; feet very short or none.	CETACEA.
4. Suctorial	GRALLATORES	Jaws much prolonged; burrow for their food.	GLIRES.
5. Rasorial	RASORES	Head with crests of horn or feathers; habits domestic: feet long, formed for walking.	UNGULATA.

Mr. Swainson considers that 'these analogies are so perfect, and the series so completely in unison with those of all other animals,' that he deems it unnecessary to go into any long details.

In further support of the relation between the *Grallatores* and *Glires* insisted on also in the 'Natural History and Classification of Quadrupeds,' Mr. Swainson adverts to the elongation of the upper jaw or mandible of these animals, a peculiarity which is more conspicuous, he says, in them and their representatives than in any other groups. 'If,' continues Mr. Swainson, 'we examine, for instance, the bill of the woodcock family, we find that its termination in regard to the contour gives an almost ludicrous resemblance to the muzzle of a rat, particularly if we fancy that both were of the same size. Now it is perfectly clear, that as these two animals when feeding generally insert their muzzle in the ground, so there can be no doubt that this particular formation is essential to that propensity. The only quadrupeds, again, which have the snout inclining upwards, are of the gliriform type; and the only birds in which the bill takes the same direction are typical of the *Grallatores*. The *Sorex*, *Dasypus*, &c., are all types of the gliriform quadrupeds, as those of *Trochilus*, *Avosetta*, *Tringa*, are of the grallatorial structure in birds: so that the resemblance of the snout of *Nasua* and *Avosetta* are as like as it is possible, considering that one is a quadruped and the other a bird. To the same type also belongs the

Echidna, or porcupine ant-eater, the American genus *Myrmecophaga*, and the Indian *Manis*: all these are pre-eminently characterized by that great prolongation of muzzle which constitutes, as before mentioned, one of the chief characters of the type we are now illustrating.' We have given Mr. Swainson's own words, that the reader may have an opportunity of forming his own opinion as to the premises and conclusion; and we must further add, with reference to this volume, that Mr. Swainson considers that the typical structure of the wading foot 'is found in the sandpipers (*Tringa*), tatlers (*Totanus*), and snipes (*Scolopax*).'

In the second volume of 'The Classification of Birds,' we find that Mr. Swainson considers that the families under which the Waders are naturally arranged are these:—'1. the *Ardeadæ*, or herons; 2. the *Charadriadæ*, or plovers; 3. the *Tringidæ*, or sandpipers; 4. the *Rallidæ*, or rails; 5. the *Tantalidæ*, or ibices (Ibises).' Mr. Swainson is of opinion that the 2nd and 3rd are the typical groups. In the same volume, farther on, we find the families of the *Grallatores* in the following order:—*Ardeadæ*, *Tantalidæ*, *Rallidæ*, *Scolopacidæ*, *Charadriadæ*, and at pages 28, 32, &c., will be found other analogical tables and explanations regarding the order.

Fossil Grallatores.

The fossil remains of the families of this order will be noticed under the articles which treat of them. But we must here state that the remains of Wading Birds occur in various strata. For instance, in the gypsum of the Paris basin (tertiary—eocene period of Lyell) the bones of birds referrible to the genera *Scolopax*, *Tringa*, and *Ibis* have been found; and, in the fresh-water formation of Tilgate Forest (secondary series) Dr. Mantell found the remains of a Wader larger than a common Heron. But this bird must have been a pygmy when compared with those gigantic Waders (apparently) whose footsteps Professor Hitchcock records as being preserved in the new red sandstone of the valley of the Connecticut. The professor refers these fossil footsteps to at least seven species of Grallatores with very long legs, and ranging from the size of a snipe to twice the dimensions of an ostrich.

These footmarks, which Professor Hitchcock names *Ornithichnites*, were found at various depths beneath the actual surface in quarries of laminated flagstones, at five places near the banks of the river, within a distance of thirty miles. The inclination of the sandstone is from 5° to 30°, and the tracks appear to have been made on it before the strata were so inclined. Seven of these tracks, which the professor figures, are considered by him to have been made by seven different species, if not genera. The footsteps appear in regular succession on the continuous track of an animal in the act of walking or running, with the right and left foot always in their proper places. There is occasionally a variation in the distance of the intervals between each footstep on the same track, but to no greater amount than the alteration of its pace by the bird would explain. Many tracks of different individuals and different species are often found crossing each other, and the footsteps are sometimes crowded together in the same manner that impressions of the feet of ducks and geese are left on the muddy shore of the stream or pond where they resort. The professor remarks however, that none of the footsteps appear to be those of web-footed birds; they most resemble, he states, those of *Grallæ* (Waders), or birds whose habits resemble those of *Grallæ*. The impressions of three toes are usually distinct, except in a few instances; that of the hind toe is mostly wanting, as in the footsteps of modern *Grallæ*. But we must now draw the reader's attention to the most remarkable among these footmarks, hitherto found in one quarry only, at Mount Thorn near Northampton, where were discovered four nearly parallel tracks of a gigantic bird, whose foot measured fifteen inches in length, exclusive of the largest claw, which was two inches in length. All the three toes were broad and thick. In one of the tracks a regular succession of six of these enormous footsteps appeared at a distance of four feet from each other; in others the distance varied from four to six feet, and it is supposed that the latter was the longest step of this Bird-giant whilst it was running.

The footsteps next to be noticed are those of another enormous bird, whose toes were however more slender than those of the last (*Ornithichnites giganteus*), but measured from fifteen to sixteen inches in length, exclusive of a remarkable appendage extending backwards from the heel eight or nine inches, and apparently intended to sustain the animal when walking on a soft bottom. The impressions of this appendage bear a resemblance to those of wiry feathers or coarse bristles, which appear to have sunk into the mud and sand nearly an inch deep; but the toes had sunk much deeper, and the mud was raised into a ridge several inches high round their impressions, similar to the elevation round the track of an elephant in clay. Six feet sometimes seem to have made the length of this bird's stride. Other tracks indicate shorter steps; and the smallest impression tallies with a foot of only an inch long, with a step ranging from three to five inches. It is to be noted that in every track the length of the step increases with the size of the foot, and is much longer than the steps of any known existing species of birds. A greater length of leg is thence inferred than that of modern wading birds; and it is considered that the steps at four feet asunder probably indicate a leg of six feet in length.

The margin of shallow water subject to changes of level, and in which sediments of sand and mud were alternately deposited, appears to have been the locality where these antient birds congregated. The inferred length of limb would have been well adapted for wading in such a place.

The bones of fishes only (*Palæothrissum*) have yet been found in the rock that has transmitted to us these footsteps, 'which are of the highest interest to the Palæontologist, as they establish the new fact of the existence of birds at the early epoch of the new red sandstone formation; and further show that some of the most antient forms of this class attained a size far exceeding that of the largest among the feathered inhabitants of the present world, and were adapted for wading and running rather than for flight.'

(*American Journal of Science and Arts*, vol. xxix., No 2, and Dr. Buckland's *Bridgewater Treatise*, 2nd edit.)

GRAMINA'CEÆ, or GRASSES, are a very extensive and important natural order of Endogenous plants, comprehending many of the most valuable pasture plants, all those which yield corn, such as wheat, barley, and maize, the sole source of colonial sugar in the sugar-cane, and the most fragrant of all plants in the form of Andropogons. Their structure is among the most simple of the perfect forms of vegetation; a stem clothed with alternate leaves whose stalks are universally thin, and constituting as many sheaths to guard the young and rapidly growing shoots, a few rudimentary leaves collected at the ends of the branches of inflorescence, and constituting flowers, a very small number of stamens, and a single seed enclosed in a thin pericarp, are all that nature provides to enable these plants to preserve their race and to distinguish their numerous kinds from one another. Yet, with such a simple apparatus, many thousand species are so precisely characterized that the natural order of grasses is perhaps one of the easiest to study and arrange, provided the task be commenced upon right principles. The floral leaves, called glumes, paleæ, and scales, offer a prodigious number of different appearances, according to the manner in which they are combined or modified; and the inflorescence, the number of stamens, the texture of the parts, or the relation of the sexes to each other, afford additional means by which the distinctive characters are varied.

This is, no doubt, one of the wise provisions of Providence by which man is enabled to distinguish good from evil, the useful from the useless, the profitable from the unprofitable. For in no class of plants is it more necessary than in grasses to know how to choose between different species. For instance, most grasses are saccharine and nutritious to cattle, but the species of holcus, bromus, &c., are as freqently worthless. There is a great difference between the value of grasses for pasture; certain kinds suit the meadows, others marshes, others upland fields, and others bleak and sterile hills, where they furnish valuable food for sheep: these kinds will not grow indiscriminately, or are not equally suitable for different soils and situations, and it is therefore essential for the husbandman that he should be capable of discriminating between them. Some indicate the quality of soil: the species of dactylis, holcus, and bromus are inhabitants of sterile land; the festucas and alopecuri of better soil; while various poas and cynosurus are found only in pasture-land of excellent quality. Most grasses are perfectly harmless, if not nutritious; yet the single species Lolium temulentum is a deleterious species in the midst of harmless lolia, and Bromus pur-

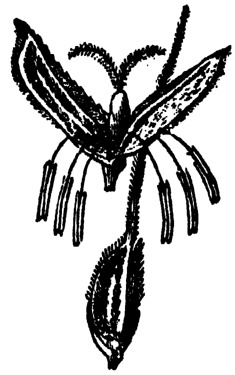
gans and Festuca quadridentata afford similar instances of this singular exception to ordinary rules.

For these and similar reasons, classification, which at all times is so necessary, here becomes the very foundation of all correct knowledge, and it has accordingly very particularly excited the attention of systematic botanists from the time when the general term Gramen was broken up by Linnæus into a number of different genera. It is not desirable in this place to show by what degrees the knowledge of botanists upon this subject has advanced from the days of Linnæus up to the present time. Those who are desirous of gaining this information should consult Palisot de Beauvois' 'Agrostographie,' published at Paris in 1812, and the subsequent writings of Brown, Kunth, Nees v. Esenbeck, and Trinius. We shall confine ourselves to a general technical description of the order, partly founded upon the *Agrostographia synoptica* of Kunth, and to brief characters of its tribes as they stand in the recent *Genera Plantarum* of Endlicher.

General Character.—*Roots* in all cases fibrous; *stem*, called culm by some authors, cylindrical, rarely compressed, varying in length from a few inches, as in Knappia agrostidea, to eighty or ninety feet, as in the bamboo; usually fistular, except at the joints, where it is always solid; sometimes solid throughout, as in the sugar-cane; coated with silex, which is also secreted occasionally in lumps in the hollows of the stem under the form of the opalescent substance called tabasheer; in most cases only of annual duration, but sometimes shrubby or arborescent. *Leaves* one to each node, with a sheathing petiole, the limb membranous, usually narrow; the sheath quite surrounding the stem, slit on one side, usually with a *ligula* at the apex. *Spikelets* terminal, panicled, racemose, or spiked; sometimes immersed in the thickened rachis; very seldom several fascicled, or united together, and surrounded by a general spathe. *Flowers* hermaphrodite, or polygamous, sometimes monœcious, very rarely diœcious, destitute of true calyx or corolla, surrounded by a double set of bracts, the outer constituting the *glumes* (or calyx of some authors), the inner the *paleæ* (or corolla of others); all together forming a distichous spikelet of one or more florets. *Glumes* alternate, the outer usually the largest and most distinctly ribbed, and often having its midrib extended into a beard or arm; sometimes both armed; sometimes the lower glume only present; occasionally both absent; these glumes are only found at the base of the spikelets, and may belong to one floret only or to many. *Paleæ* usually in pairs, and alternate with each other; the lower and outer 1-3-many veined, usually keeled, awned or awnless; the upper and inner usually two-veined, more membranous, smaller, awnless, sometimes absent. *Hypogynous scales* regarded by Kunth as remains of the ligula; by most other botanists as the rudiments of a corolla, usually two on each side of the base of the inner palea; sometimes a third is added in front of the inner palea; sometimes united with each other, sometimes deficient. *Stamens* hypogynous, usually definite, very rarely indefinite; if six or three, placed all round the ovary; if fewer than three, placed next the outer palea; filaments long and flaccid; anthers versatile, linear, bifid at each end. *Ovary* solitary, simple, with two styles (rarely three), each having a feathered or branched stigma, one-celled, with a single ovule attached to the pericarp by the whole side, or the lower part of the side next the upper palea. *Fruit* a caryopsis in most cases, occasionally an utriculus; the pericarp thin and membranous, in the former case adhering firmly to the seeds, in the latter distinct from it. *Seed* containing a large quantity of floury albumen, on one side of which (that next the lower palea) there lies a lenticular *embryo*, composed of a thin cotyledon, whose edges are doubled outwards over the plumula and radicle, which therefore press upon the side of the pericarp next the outer palea. The *plumula* is free, and consists of several sheaths overlying each other; the radicle is composed of several tubercles which break through the sides of the embryo as soon as germination commences.

Under this character M. Kunth assembles about 2500 species, a number far below the real amount, and M. Endlicher 234 genera, which are classified by the latter botanist as follows:—

Tribe I.—Oryzeæ. Spikelets sometimes one-flowered, with the glumes frequently absent; sometimes two-three-flowered, with the lower florets consisting of but one palea, and neuter, the upper only being fertile. Paleæ of a stiff papery texture. Flowers often unisexual, usually hexandrous.



Oryza.

Tribe II.—Phalarideæ. Spikelets hermaphrodite, polygamous, or rarely monœcious; either 1-flowered, with or without a stipitiform rudiment of an upper floret; or 2-flowered, with both florets either hermaphrodite or male; or 2-3-flowered, with the terminal floret fertile, the rest incomplete. Glumes usually equal. Paleæ often shining, hardened in the fruit. Styles or stigmas mostly long.

Phleum.

Tribe III.—Paniceæ. Spikelets 2-flowered, the lower floret being incomplete. Glumes thinner than the paleæ, the lowermost often, occasionally both, being abortive. Paleæ more or less coriaceous or papery, usually awnless, the lower concave. Caryopsis compressed from the back.

Streptostachys.

Tribe IV.—Stipeæ. Spikelets 1-flowered. Lower palea rolled inwards, awned at the apex, and usually indurated in the fruit; awn simple or trifid, usually twisted, and articulated at the base. Ovary stipitate. Squamulæ usually three

Stipa.

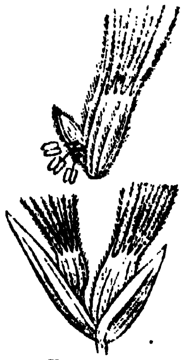
Tribe V.—**Agrostideæ.** Spikelets 1-flowered, very rarely with the awl-shaped rudiment of an upper flower. Glumes and paleæ 2, membranous-herbaceous; the upper palea usually aristate. Stigmas usually sessile.

Apera.

Tribe VI.—Arundineæ. Spikelets either 1-flowered, with or without the rudiment of an upper floret, or many-flowered. Florets usually surrounded or covered with long soft hairs. Glumes and paleæ 2, membranous-herbaceous, the former usually as long as the florets or longer, of the latter the lower awned or awnless. Usually tall grasses.

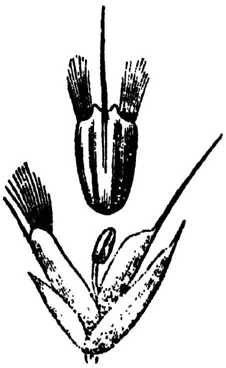
Calamagrostis.

Tribe VII.—Pappophoreæ. Spikelets 2-many-flowered, the upper withering. Glumes and paleæ 2, membranous-herbaceous. Lower palea with 3 or more subulate awned divisions. Inflorescence capitate-spiked or panicled.



Eunenpogon.

Tribe VIII.—Chlorideæ. Spikelets in unilateral spikes, 1-many-flowered; the upper florets withering. Glumes



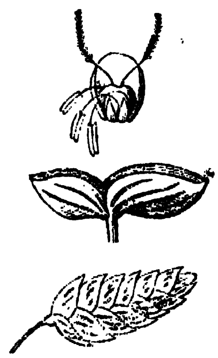
Chloris.

and paleæ 2, membranous-herbaceous, the latter awnless or awned, the former permanent on the rachis, and the anterior one inserted higher up than the other. Spikes digitate or panicled, rarely solitary. Rachis continuous, not jointed.

Tribe IX.—Aveneæ. Spikelets 2-many-flowered; the terminal floret usually withering. Glumes and paleæ 2, membranous-herbaceous; the lower palea mostly awned; the awn usually dorsal and twisted.

Danthonia.

Tribe X.—Festuceæ. Spikelets many-flowered, rarely few-flowered. Glumes and paleæ 2, membranous-herbaceous, rarely coriaceous, the latter usually furnished with an awn which is not twisted. Inflorescence almost always panicled.



Briza.

Tribe XI.—Hordeæ. Spikelets 3-many-flowered; sometimes 1-flowered. Terminal floret withering. Glumes (occasionally deficient) and paleæ 2, herbaceous. Stigma sessile. Ovary mostly hairy. Inflorescence spiked; spike simple, solitary; rachis sometimes winged. In this tribe are collected the Cerealia, namely, wheat, barley, rye, &c.

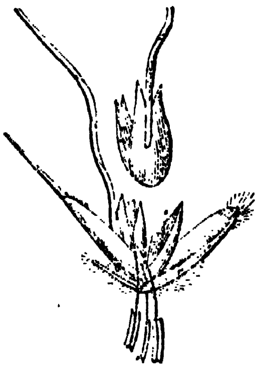
Hordeum.

Tribe XII.—Rottboelleæ. Inflorescence spiked; the rachis in most cases jointed. Spikelets 1- 2- or very rarely 3-flowered, lodged in hollows of the rachis; either solitary or in pairs, one being stalked and withering. One floret of each spikelet, either the upper or the lower, usually incomplete. Glumes 1-2, sometimes altogether wanting, mostly coriaceous. Paleæ membranous, awnless, or now and then

awned. Style 1-2, sometimes very short, or altogether absent.

Rottboella.

Tribe XIII.—ANDROPOGONEÆ. Spikelets 2-flowered; the lower floret being almost always incomplete. Paleæ thinner than the glumes, usually transparent.



Pogonatherum.

GRAMMAR. [LANGUAGE.]

GRAMMONT, a town in the province of East Flanders, built on both sides of the river Dender, in 50° 41′ N. lat. and 3° 50′ E. long., and 18 miles south-south-east from Ghent. Grammont was founded in 1068 by Count Baldwin of Mons, who purchased the site and surrounded it with walls and ditches. The town contained in 1834 a population of 7349; it had then 1401 houses, two churches, four chapels, a town-hall, an hospital, a college, five schools, and an orphan-house. The chief branches of industry pursued by the inhabitants are cotton-spinning, dyeing, bleaching, tanning, soap-boiling, distilling, brewing, and oil-crushing.

GRAMMONT, COUNT, a celebrated personage of the age of Louis XIV., served in the army with great distinction, and rose to the rank of lieutenant-general, but he acquired his celebrity by his great wit and his relations with the most eminent persons of his day. He spent some time at the court of Charles II. of England. During his residence in England he engaged to marry Miss Hamilton. Forgetting or neglecting his promise, he set out to return to France; but being joined by two of the lady's brothers at Dover, and asked whether he had not forgotten something, 'Yes, indeed, I have forgotten to marry your sister,' answered Grammont, and immediately returned to complete his engagement. Grammont died in 1707, aged 84. His memoirs, which were published by his brother-in-law Anthony Hamilton, are admitted to be the cleverest production of that kind; they abound in wit and animation, and present a lively, although sometimes disgusting, picture of the profligate court of Charles II. They have gone through many editions in Paris as well as in London. Of the following edition only 100 copies were printed:—*Mémoires du Comte de Grammont, nouvelle edition augmentée des notes et éclaircissemens nécessaires, par M. Horace Walpole*, Strawberry Hill, 1772, in quarto, with three portraits. Of the English editions the best is that of 1811, in 2 vols., with 63 portraits, and many notes and illustrations, some of which are ascribed to Sir W. Scott. (Lowndes's *Bibliographical Manual*, vol i., p. 863.)

GRAMPIAN MOUNTAINS. This name, which occurs in Tacitus (*Agric.*), designates a mountain-range or region in Scotland, and though the term is not used by the natives of that part of Britain, it has been adopted by geographers from the necessity of giving distinct names to mountain-ranges. Geographers however do not agree in the application of this name. Some apply it generally to all the ranges north of the parallel of the Friths of Forth and Clyde, and west and north of Strathmore; others however limit it to the range which traverses the whole breadth of Scotland near 57° W. lat., and thus leave without a name that range which runs from the Frith of Clyde nearly due north and terminates on the banks of Loch Rannoch.

The last-mentioned range may be called the Southern Grampians. It begins on the shores of the Frith of Clyde at Point Toward, which constitutes the most southern extremity of the most eastern of the promontories in which the peninsula of Cowal terminates on the south. Cape Toward is of moderate elevation, but at a short distance behind it the mountains begin to rise, and continue to increase in elevation; where they inclose Loch Eck, their highest summits are from 2500 to 3000 feet above the sea. They are somewhat lower between the northern angles of Loch Fyne and Loch Long, but to the north of the last-mentioned inlet they unite with the mountains of Arroquhr, which divide Loch Long from Loch Lomond, and are of less elevation. After this union the range again rises to about 3000 feet; and where it skirts the eastern side of the narrow valley of the river Orchy in Argyleshire it contains several high summits, and the great mountain-masses of Benichevan, Benloighe, Benour, Benduran, and Bendoe. To the north of Bendoe it terminates in some lower mountains on the banks of Loch Rannoch, or rather turns abruptly to the east, and runs in that direction to the place where the Garry river joins the Tumel, forming the southern boundary of the valley of the Tumel, and comprehending the high summit of the Schehallien. Its length from south to north is about 50 miles, and its breadth in that quarter between 12 and 15 miles. The eastern offset is about 20 miles long, but hardly more than 5 or 6 miles wide. A carriage-road leads over the range between Benloighe and Benour, from Glen Tay to Glen Orchy. Several lateral ranges branch off from the Southern Grampians to the east, and advance as far as Strathmore. In the southern districts they extend only about ten miles from the principal range, but farther north this distance is increased to nearly 20 miles. These lateral ranges contain several very high summits, as Ben Lomond, Ben Venu, Ben Ledi, Ben Vorlich, Ben Lawers, Ben More, &c. [BEN.]

The Central Grampians commence on the western coast of Scotland with the enormous mass of Ben Nevis [BEN], contiguous to which on the east and extending as far as Loch Ericht there is a dismal mountain-region, which however contains no very elevated summits, but is covered with bare rocks towering one above another, separated by frightful precipices and intersected by numerous bogs. No district of Scotland is less visited by man than this mountain-tract. East of Loch Ericht the mountains rise again, but not directly to a great elevation, and here in the Forest of Drummacher is the mountain-pass through which the most frequented road runs; it leads from Perth through the valley of the Spey to Inverness. At some distance east from this pass the mountains rise higher in the extensive group of Ben-y-Gloe, whose highest pinnacle attains an elevation of 3690 feet above the sea. The range continues eastward, with several summits exceeding 3000 feet in elevation, and may be considered as terminating in Caerloch (1890 feet), 18 miles west by north from Stonehaven. A lower range advances within three miles of that town, and another runs north-east to the mouth of the Dee, where it terminates at Cape Girdleness. The length of this range may be nearly 100 miles; its width varies between 12 and 20 miles, and its average height may be estimated at about 2000 feet above the sea.

The offsets from the Central Grampians towards the south are numerous, but of no great length. From its northern side however there issues a range, which on account of its elevation and extent may be distinguished by the name of the Northern Grampians. This range is connected with the Central Grampians near the vast mountain-mass of Ben-y-Gloe, from which point it runs north by east for about 15 miles; it then forms the still more extensive and more elevated group of the Cairn Gorm Mountains, inclosing on all sides a mountain-lake, which is the source of the river Avon, an affluent of the Spey. Here stands Ben Mac Dhu, whose sum-

mit is second in elevation only to Ben Nevis. The range here divides into two branches, of which the western runs due north, separating the river Avon from the valley of the Spey. It is called the Braes of Abernethy, and terminates at the junction of the Avon and the Spey in the mountains of Cromdale. The eastern branch, which runs due north-east, lowers considerably, and may be considered as terminating in the mountains west of the upper course of the river Doveran, though a ridge of hills advances farther north, and approaches the Firth of Moray within a few miles. The length of the Northern Grampians is about 30 miles; their width is hardly anywhere 10 miles; except at the mountain-knot of the Cairn Gorm, where it is much wider.

(Sinclair's *Statistical Account of Scotland;* MacCulloch's *Highlands and Western Islands;* Lauder's *Account of the Great Floods in the Province of Moray.*)

GRAMPOUND. [CORNWALL.]

GRAMPUS. [WHALES.]

GRAN, or, in Hungarian, *Esztergom Varmegye*, a county of central Hungary, bounded on the south-east by that of Pesth, and on the west by that of Comorn, is divided by the Danube into two nearly equal portions. Its area is about 400 square miles. The northern part is in general level, but the southern is rendered extremely mountainous by the last ranges of the Vertesh and Pilish chains, which leave however an extensive plain between Mount Gete and the banks of the Dorogh. About 84,000 acres are arable land, 28,000 are meadows and pastures, and 9000 are in vineyards. The forests occupy about 71,000 acres. Gran is watered by the Danube, the Gran, which gives its name to the county, the Dorogh, and several lesser rivers; the Danube and Gran abound in fish. The soil, though partially sandy and sterile, is in general very favourable to the growth of corn and the vine: it produces considerable quantities of barley and wheat, as well as red and white wine of good quality, much timber, and all kinds of fruit. The country contains marble, potters' clay, coals, and salt. The rearing of cattle is inconsiderable. The air is pure, but the climate is exposed to great extremes of cold and heat. The population, of whom three-fourths are Roman Catholics, and about the same number Magyárs, the remainder being Sclavonians and Germans, is about 53,000. The county is divided into the two districts of Gran and Párkány, and contains 1 town, 4 market-villages, 45 villages, and 3 prædia, or privileged settlements.

GRAN, the chief town of the district (called in the native tongue Esztergom, and in Sclavonian Ostrihom), is situated on the right bank of the Danube, near the efflux of the Gran into that river, in 47° 47′ N. lat. and 18° 45′ E. long. It is a royal free town, the place of assembly for the county states, and gives its name to an archiepiscopal see. It has a strong castle on a rocky island in the Danube, which has undergone several sieges, and at the foot of which are warm baths. The population is about 10,950, and the number of houses about 790. Among other public buildings are the cathedral and chapter-house, the house of assembly and town-hall, a gymnasium conducted by Benedictines, which has about 350 scholars; 3 Roman Catholic churches, a Greek church, an abbey, an hospital, and a Franciscan monastery. Gran has seven suburbs, of which the 'Water-town,' at the foot of the castle, which is connected with the town by a flying-bridge, belongs to the archbishop, who is primate of Hungary, and has not only the privilege of crowning the sovereign, but of granting letters of nobility. The weaving and dyeing of woollen cloths is the chief employment of the inhabitants. Gran is supposed by many to have been founded by the Romans, and to be the Bregetium of Ptolemy. By a conflagration in April, 1818, 220 houses, 2 chapels, a hospital, and other public buildings, were destroyed.

GRANA'DA, a province of Spain, also called Upper Andalusia, is bounded on the east by Murcia, on the south by the Mediterranean, and on the north and west by the rest of Andalusia. Its figure approaches to that of a triangle, having its base to the east, and its apex towards Gibraltar. Its length from east to west-south-west is about 240 miles; its breadth varies from about 30 to 80 miles. The area is probably about 9000 square miles; the population, which can hardly be estimated with probability, is variously stated at 700,000 and 850,000. Its principal towns are Granada, the capital; Malaga, a port chiefly of exportation; Almeria, Almañecar, two ports of importation; Guadix, Motril, Marbella, Velez-Malaga, Baza, Vera, Ronda, Loja, Santa Fe (founded by the besiegers and conquerors of the capital, but now almost ruined by earthquakes), Antequera, and Alhama.

Granada is the new state which, after the downfal of the Ibero-African empire, was founded in 1238 by the great Mohammed Ben Alhamar, and was raised by him and his successors to a high degree of splendour and refinement. The human mind indeed advanced quicker and soared higher among the Arabs transplanted into southern Spain than it ever did elsewhere among any other race. Paper, printing, the mariner's compass, glass, porcelain, gunpowder, &c., are mentioned as anticipated discoveries made by them. The poetess Naschina, the historian Mosada, the mathematician Leila, testify what eminence even the female mind attained under the influence of Oriental habits and opinions.

Besides the love of learning, agriculture, stimulated by a dense population, was held in respect and carried by the Moslem Granadians to a high degree of excellence. Spain is indebted to them for the introduction of her most exquisite fruits and horticultural products, for the sugar-cane, cotton, silk, &c., and, above all, for the skilful culture of the mulberry-tree, and for the best mode of irrigation, and of distributing water for that purpose among numerous plots of ground. Land so watered yields 50 bushels of wheat per acre. Their skill was also shown in the manufactures of woollen cloths, cotton, flax; and the swords and dyed leather of Granada were once the best in Europe. Their commerce likewise became extensive, and the luxuries of India and Alexandria were enjoyed in this most highly-favoured region.

The whole of this province is diversified with majestic mountains, delightful valleys, and wide plains: it has also an extensive line of coast. The Sierra Nevada, the loftiest mountain-range in the Peninsula, raises its brilliant snow-crowned summit, called Mulhacen, 13,572 feet above the sea, from which mariners observe it at a great distance. The perpetual snow begins at an elevation of 9915 feet. The Alpujarras stretch east and west between the Nevada and the sea, and at the western end of this range the Sierra de Lujar (6850 feet high) has its summit crowned with snow during six months. The Sierras de Gador, Bermeja, and Ronda, are as wild as the central group of the Nevada. The eastern part of the province is covered with offsets of the great Iberian chain.

Many promontories stretch into the sea, forming deep bays and sheltered harbours. The Jenil, the amplest tributary of the Guadalquivir, the Guadix, the Guadiaro, Guadelmedina, which washes Malaga, the Motril, the Almeria, &c., are the principal streams. The mineral springs, some of which are much recommended, would make a long list. There are copious salt-springs in the mountains of Antequera. The soil, although stony in the mountains, light in the plains, and very sandy towards the coast, is nevertheless covered with a luxuriant vegetation. The sumac and the cork trees, the oak bearing the edible fruit, and many other valuable trees and shrubs, form the extensive thickets of the Sierras. Wheat returns at least 24 fold in the valleys, maize 80 or 100, and other products in a similar ratio. The excellent system of tillage and irrigation established by the Moors has survived in spite of clerical intolerance and the neglect of the lordly owners of the soil; and the Vega of Granada, adjoining that capital, is still a luxuriant garden, and perhaps the most enchanting spot in Europe. In the midst of that plain is the once princely seat of Soto de Roma, which the Spanish Cortes in 1813 transferred, with all its appendages, to the Duke of Wellington.

Goats are very numerous in this province, and thrive well, but sheep have a coarse wool inclining to hair. Asses and mules are as strong and well shaped as in Tuscany; but the breed of horses is inferior to that of Cordova. Tunny and anchovy fisheries are carried on with profit. The collecting of cantharides is also a branch of industry. Metals are abundant in the mountains. Near Cangajar alone there are 117 lead mines. Copper ore lies on the surface in many places; antimony and quicksilver are found near Malaga, and molybdenum at Ronda. Coal is found on the margins of the Beiro and of the Alfacar, near the capital. Exquisite marbles and jaspers are common, and the best alabaster in Europe comes from the Alpujarras. From fluate of lime, similar to Derbyshire spar, sundry ornamental pieces are made. An enormous block of marble, called Sierra de Gador, rises 7800 feet above the sea. Another mass of marble, white and pure, and

about four miles in compass and 2000 feet in height, stands between Almeria, Granada, and Guadix, and is known by the name of Sierra de Filares. In spite of untoward political events and the consequent depression of industry and trade, this province is in both respects far before all the rest of Andalusia.

Malaga is still a vast depôt and a great place of export for native produce. Its far-famed batata is not a real potato, or solanum, but a convolvulus. Almeria and Adra export lead, and the amount is on the increase since the working of new mines, which it is said (though we do not know with what truth) have had the effect of preventing, or at least diminishing, the earthquakes which were formerly common.

The climate is generally healthy; but sometimes, when the solano blows from Africa on the coast, the air is so sultry, so intolerable, and so pernicious to all animal as well as vegetable life, that this wind might appropriately be termed the Bætic simoom.

GRANADA, a city of Spain, and capital of the province of that name, the seat of an archbishopric, and till lately of a chancery, or supreme court of appeal for all Andalusia, Estremadura, and part of Castile. It is situated at the foot of the Sierra Nevada, and at the termination of La Vega, a rich garden which is itself the best part of a sloping plain, 30 leagues in circumference, where nature and art combine in bringing forth beauty and plenty.

This city was built in the 10th century by the Saracens, out of the ruins of the adjoining municipal Conventus of Illiberis, and belonged to the kingdom of Cordova. After the overthrow of this empire, Granada became in 1238 the no less celebrated capital of the new kingdom, and the last bulwark of the Moslems in the Peninsula. It increased to the extent of three leagues in circumference, and in 1311 had a population of 280,000, which some have carried even as high as 400,000 at a later date; and finally, in 1491, 100,000 men defended its walls and fortresses against all Christian Spain under Ferdinand and Isabella, who reduced it on the 2nd day of the year 1492. The Alhambra and the Generalife (whose balconies offer the best prospect perhaps in Europe), Torres, Bermejas, &c., are the principal but faint memorials of its Arabian grandeur, and of the taste with which a spot was embellished, so highly gifted by nature, and once so improved by human industry. Charles V. added to these monuments a palace within the Alhambra, which was never finished.

Granada stands on and between two hills, about 2445 feet above the level of the sea, in 37° 17′ N. lat., and 3° 50′ E. long. The lively stream of the Darro intersects the city, and renders it clean and healthy by the distribution of its waters even to the humblest dwellings. The Jenil, which bathes its skirts, but sometimes inundates part of the city, joins the former stream close to it, and becomes eventually the amplest tributary of the Guadalquivir. Both rivers, with their shaded banks forming the charming walks of Carrera de Darro, Carrera de Jenil, which latter has of late been greatly improved, render the country round remarkably picturesque. This effect is heightened by many gardens called carmenes, from the Arabic word karam, a vineyard, for which purpose they were originally laid out. All these advantages of soil are enhanced by its salubrity and by the cool breezes from the Sierra Nevada, which refresh the atmosphere even in the dog-days. No wonder that the Moors left such a spot reluctantly, and still sigh and pray for the restoration of their empire of Granada.

The aspect of the city at a distance is imposing; but this effect is removed on entering it by the intricacy, steepness, and narrowness of its streets, and by the mean appearance of the houses. In the level parts however there are spacious squares, as the handsome Plaza del Triumfo, Vivarambla, &c., and stately buildings are erected. The cathedral, though irregular, is a splendid structure, profusely ornamented with exquisite jasper and marble works from the quarries of the neighbourhood. Beneath its fine dome, which rests on twelve arches, supported by as many pilasters, stands the high altar, on the decoration of which the wealth of the kingdom was lavished. This church also contains some of the best pictures and statues of Alonzo Cano, and of his pupil Pedro de Mena. Annexed to it is the Capilla de los Reyes, where the bodies of Ferdinand and Isabella are deposited. Casts of the fine monuments in this chapel (which are that of Ferdinand and Isabella, and that of Jane and her husband Philip of Burgundy) have recently been taken at an enormous expense for the French gallery of the Louvre. The principal buildings are the church of San Jerónimo, which contains the monument, the remains, and the sword of Gonzalo de Cordova; that of the Chartreux, whose vault is painted in fresco by Antonio Palomino; that of Las Angustias noted for its splendid high altar; that of Santa Cruz, &c.; and more particularly the extensive general hospital, or infirmary for all complaints, even lunacy, of San Juan de Dios, the first of the kind founded in Spain; and, singularly enough, an inscription at its entrance records that its founder, Don José Robles, 'hizo tambien los pobres' (made also the poor), an expression which has become proverbial in Spain. To these may be added the archiepiscopal palace and that of the former Court of Chancery, the Alcahiceria, or Moorish bazaar, still containing some 200 small shops. Numerous fountains also adorn the city. Besides a university founded in 1526, there are six colleges, a mathematical academy, a politico-economical society (Sociedad de Amigos del Pais—which by the by should rather be called de Amantes del Pais—an institution common to many Spanish cities), and a school of design, modelling, and drawing of the human figure from life. There is also a royal manufactory for saltpetre and gunpowder, and several for silk stuffs, such as velvet, taffetas, satin, and handkerchiefs, which are very durable, and more particularly for ribands (listoneria), in the making of which the Coventry spring-shuttle is adopted. The sewing silk of Granada is preferred to all others.

The once numerous and celebrated silk manufactures of the city have greatly declined since the separation of the Spanish provinces of South America. Those of sailcloth, as well as the culture of hemp, have suffered no less since the almost complete annihilation of the Spanish navy. In the general wreck of Granadian industry there remains a branch less decayed than the rest, that of coarse woollen cloth, which is carried on in the Albaycin, a thickly-peopled quarter occupied by descendants of the Moorish refugees from Baeza.

Granada has given birth to many illustrious men, such as Fai Luis de Granada, the star of Spanish orators; Luis del Marmol, the author of a general description of Africa, much valued; the Jesuit Suarez, who gave his name to the Suaristas; Alonzo Cano, before mentioned; the poet Lope de Rueda, the Spanish Thespis, and anterior to Lope de Vega; Hurtado de Mendoza, the Spanish Sallust, &c.

The present population is 80,000.

(Antillon, *Geographia Fisica y Politica de España y Portugal*, 3rd edit., 1824; Pablo Lozano, *Antiguedades Arabes de España*, 1780, 1804 (the source which posterior authors have resorted to); Miñano, *Diccionario Geografico de España*; *Antiguedades Supuestas de Granada* (a very rare work on some pious frauds and curious forgery of inscriptions carried on in the last century at Granada, which called forth the interference and the severity of the law); Jacob's *Travels in Spain*; Swinburn's *Travels in Spain*; Colmenar, *Délices del Espagne*; Laborde, *Itinéraire Descriptif de l'Espagne*.)

GRANADA, NEW, is one of the three republics in South America which were formed when the republic of Colombia was dissolved. [COLOMBIA.] It comprehends the countries which belonged, before 1810, to the vice-kingdom of New Granada, with the exception of the most southern districts, which now constitute the republic of Ecuador. [ECUADOR.] The boundary-line between Granada and Ecuador is not exactly settled, but it lies between 1° and 2° N. lat. From this line New Granada extends northward to the Colombian Sea, where its most northern point is in 12° 30′ N. lat. It lies between 70° and 83° W. long. Its area is estimated at 470,000 square miles, or somewhat more than the surface of France.

On the south it borders on Ecuador, from which it is partly separated by the river Guainia, or Rio Negro; on the east on Venezuela, where the Orinoco and two of its branches, the Cassiquiare and the Apure, chiefly form the boundary-line. From Central America it is divided by an imaginary line running across the Mexican isthmus from Pt. Boruca (near 83° W. long.) to the Caribbean Sea, a little west of the lagoon of Chiriqui. The western part, which is more than half of its surface, is comprehended within the range of the Andes; the eastern belongs to the great plains, or Llanos, of the Orinoco river.

The Region within the Andes.—On the boundary-line between New Granada and Ecuador, but rather within the

last-mentioned country, is the mountain-knot De los Pastos, with its numerous volcanoes. North of it extends a mountainous country, inclosing the valley of Almaguer, which is shut in on the east by that portion of the Andes which is called Paramo de Aporte and de Iscanse, but on the west by the range called Cordillera de la Costa, or Paramo de Momacondy. These two ranges are about 80 miles distant from one another, and the mountain-region between them contains the valley of Almaguer, which is about 6900 feet above the sea-level, and is drained by the Rio de las Patias, which breaks through the Cordillera de la Costa, and falls into the Pacific. About 2° 9′ N. lat both ranges are united by a transverse range, called the Sierra de Socoboni. On the north of this transverse range the great mass of the Andes separates into three great ranges, which, running north and north-east, enclose the valleys of the rivers Magdalena and Cauca. They are called the Western, Central, and Eastern Andes of New Granada.

The Western Andes are to be considered as a continuation of the Cordillera de la Costa, as they continue in the same direction north-north-east. However they soon lower considerably, and between 3° and 4° N. lat. their mean elevation hardly exceeds 5000 feet. But north of 5° N. lat. they have some high summits; the Pico de Torra, south-east of Novita, perhaps rises to 10,000 feet above the sea. In this part the range, which farther south hardly exceeds 20 miles in width, grows much wider, filling up the whole space between the Rio Atrato and the Rio Cauca, with numerous summits, among which the Alto de Viento is more than 9000 feet high. The offsets from this chain extend to the north, and cover the whole country between the Gulf of Darien and the Rio Cauca. They terminate, not far from the sea, in hills which approach the road leading from Cartagena to Baranca on the Rio Magdalena. A low ridge, which branches off from the Western Andes at the sources of the rivers S. Juan and Atrato (near 6° N. lat.), divides the valley of the last-mentioned river from the Pacific, and seems to sink into the plain of the isthmus of Panama, at about 7° 30′, or to continue only in detached hills. Though the Western Andes in general do not attain a great elevation, nor occupy a great width, they are extremely difficult to cross on account of their great steepness. Six or seven mountain-passes are known to exist, but none of them can be passed by beasts of burden; men and goods are transported on the backs of porters.

The Central Andes of New Granada begin at the eastern extremity of the Sierra de Socoboni, and run nearly due north in a straight line between the valleys of the Cauca and Magdalena. This is the most elevated of the three ranges, and south of 6° N. lat. has a mean elevation of probably not less than 12,000 feet. Several of its summits are always covered with snow, as the Nevados of Huila, Baraguan, Tolima, and Herveo. The peak of Tolima attains 18,336 feet, and is the highest mountain in South America north of the line. The breadth of this range is likewise greater than that of the Western Andes, exceeding probably 60 miles. North of the Nevado de Herveo (between 5° and 6° N. lat.) it grows much wider, forming a mountain-tract which extends close to the eastern banks of the river Cauca, but remains at some distance from the Magdalena river. This part of the range however is less elevated. Its mean elevation probably does not exceed 10,000 feet, and none of its summits pass the snow-line. From this mountain-tract a long offset extends north to no great distance from the place where the Magdalena and Cauca rivers join. Two mountain-passes are much used. The more southern leads over the Paramo de Guanaco, at no great distance from the Sierra de Socoboni, and unites La Plata with Popayan. Its highest point seems to exceed 10,000 feet. Farther north is the mountain-pass of Quindiú, which skirts the foot of the Nevado de Tolima, and in its highest point the Garita de Paramo attains 11,500 feet.

The Eastern Andes of New Granada branch off from the Sierra de Socoboni, near the place where the Central Andes begin; they run first north-east through a space of about one degree, and then turn nearly due north, and continue parallel to the Central Andes as far as 5½° N. lat. Farther north they decline to the north-east, and in this direction enter Venezuela, and terminate in some high hills south of Coro. South of 4° N. lat. this range is one immense mass of rocks, without valleys, and steep on both declivities. None of the summits exceed 12,000 feet, and the mean elevation may be 10,000 feet; the width is between 30 and 40 miles. North of 4° N. lat. the mountain-mass extends gradually to 80 or 100 miles in width, comprehending within its bosom extensive plains with a level or undulating surface. These plains extend along the western declivity of the mountain-range, and are from 5000 to 8000 feet above the sea-level. Such are the mountain-plains of Bogotà, Tunja, Sogamosso, Girona, and Rosario de Cucuta. These plains are separated from one another by ridges of moderate elevation. That which divides the plains of Girona and Cucuta, called the Sierra de Ocaña, seems to attain a greater elevation; and it runs nearly due north, and terminates in a low plain between 9° and 10° N. lat. A low and in some places hilly country, about 100 miles in width, separates the northern extremity of the Sierra de Ocaña from the Nevado de S. Marta. Only two summits of the Eastern Andes attain the snow-line, the Nevado de Chita (5° 50′), and the Nevado de Merida or Mucuchies; the latter is in Venezuela. The Nevado de S. Marta is an insulated mountain-mass lying between 10° and 11° N. lat. and 73° and 74° W. long., about 30 miles from the Caribbean Sea. In length from east-north-east to west-south-west it does not exceed 60 miles, and in breadth is probably less than 20 miles. Three of its summits rise above the snow-line.

The Rio Magdalena rises where the two ranges of the Eastern and Central Andes begin, near 2° N. lat. and runs in a narrow valley with a rapid course as far as 3° 20′ N. lat., where the valley enlarges to 40 or 50 miles in width. In this valley its course is gentle; but at 4° 40′, where the mountains approach the river on each side, and especially on the east, the current of the river becomes quicker. Below Honda eleven rapids occur which render the navigation difficult and even dangerous, and only cease at Badillo (near 8° N. lat.). The river falls 670 feet in about 200 miles, and in this part the valley is rarely 10 miles wide, and sometimes not half so much. Below Badillo it widens to 60 miles and more, and the river divides into two branches which enclose an island about 20 miles long and 10 miles wide. Both branches are navigable; the eastern runs with greater rapidity and is only used in descending, while the more gentle current of the western is more favourable to ascending boats. The Rio Magdalena afterwards declines more to the north-west and meets the Rio Cauca below Mompox; it then again turns to the north and runs through a wide plain, past Barancas, to the Caribbean Sea. About 60 miles from its mouth it divides into two branches, of which that which continues due north is the principal, and forms at its outlet the small harbour of Savanilla: but this branch is little navigated. The other branch, which turns to the north-east and is much more used, forms in its course several small lakes and terminates in the Cienaga de S. Marta, an extensive lagoon, or salt-water lake, with a mean depth of six or seven feet, which communicates with the sea by a narrow canal some miles south-west of S. Marta, but has a bar at its entrance. The whole course of the Magdalena river may amount to 840 miles, being nearly equal to that of the Rhine.

The valley of the Magdalena above Honda extends in a generally level plain, which has probably an elevation of 1500 or 2000 feet above the sea. The river and its tributaries run in smaller valleys three or four miles wide and a few hundred feet depressed below the surface of the plain. At Passo de Guayacana, nearly due west of Bogotà, the surface of the Magdalena is still 1200 feet above the sea-level. The valleys along the rivers produce abundantly sugar, tobacco, cocoa, and the common agricultural crops of the tropics, yams, mandiocca, Indian corn, batatas, and bananas. Rice is not cultivated, because the soil is too well drained. The upper plain is in some parts fertile: in others rather sterile, and covered with bushy trees. The seasons are regular. In June, July, and August not a drop of rain falls; between September and February showers are rather frequent. Heavy rains follow in February March, and April, and the weather in May is variable. Every day a strong wind begins towards noon to blow from the south, and continues till sun-set; it causes great heat, but is considered as healthy. The narrow part of the valley between Honda and Badillo and the wider one north of Badillo are very little elevated above the river, and therefore subject to frequent inundations. Though fertile and producing large crops, especially of rice, it is very little inhabited, on account of its un-

healthiness, being subject to daily rains, and never enjoying the slightest breeze except when thunder-storms occur, which are common during the night. The vapours arising from the numerous swamps and pools render it extremely unhealthy.

The Rio Cauca rises in the Paramo de Guanacas, east of the volcano of Purace, and not far from the sources of the Magdalena. It runs for 50 or 60 miles in a narrow valley between high mountains nearly due west, passing within a mile of Popayan. It then turns north and enters the wide valley at the village of Quilachoa. This valley, which may be on an average about 30 miles wide, extends to the north of Cartago, nearly 180 miles in length. The course of the river is gentle. About 30 miles north of Cartago it enters a narrow glen, formed by the high mountains on both sides; which does not contain level ground enough for a road. In this glen the river flows with astonishing rapidity, forming a succession of rapids and cataracts, from Salto de S. Antonio to Boca de Espiritu Santo about 120 miles, and within this distance falls probably not less than 2500 feet, its elevation at Cartago being about 3000 feet above the sea. Issuing from this glen it enters a wider valley, which grows still wider north of the town of Antioquia, where the river declines to the north-east and meets the Magdalena below Mompox. The whole course of the river may be about 660 miles.

The wide valley of the Upper Cauca is from 3000 to 4000 feet above the sea-level, and has a healthy and not very hot climate and regular seasons. The two rainy seasons occur about the time of the equinoxes, with an interval of dry seasons between them. Along the river the plain is low and marshy, subject to periodical inundations and mostly overgrown with rushes and reeds, but at no great distance from its banks the country rises higher and extends partly in savannahs and partly in wooded plains. In many districts it is cultivated, and produces rice and Indian corn in abundance, as well as sugar, cacao, coffee, and tobacco; but by far the greatest part serves as pasture-ground for numerous herds of cattle and horses. About Cartago the surface of the plain is undulating and less fertile. In the hills which skirt the Central Andes are thick layers of a reddish sand, which contains numerous particles of gold; considerable quantities are washed every year. The valley of the Lower Cauca, about Antioquia and farther to the north, has not been visited by intelligent travellers. Its character is not known, but it is supposed not to differ much from that of the Rio Magdalena below Honda.

The country west of the Western Andes and between them and the Pacific contains the basins of the rivers Atrato and S. Juan, and a rather narrow tract along the sea-shore. The account given under ATRATO is also applicable to the river S. Juan. The tract along the sea has a soft, alluvial, and very fertile soil, but being almost incessantly drenched by rains, it is nearly a continual swamp and extremely unhealthy, especially for Europeans. It has accordingly been abandoned to the native tribes and a few negroes, who are employed to wash the gold-sand which is found along the western declivity of the Andes in great abundance, and is at some places intermixed with platinum. Europeans make only hurried visits to it, and their accounts of this part of New Granada are unsatisfactory. For a description of the Isthmus of Panama and the contiguous district of Veragua, see PANAMA.

As for the table-lands which extend along the western declivity of the Eastern Andes, the most southern, those of Bogotà [BOGOTA], and Tunja, are from 8000 to 10,000 feet above the sea, and on them the grains and fruits of Europe are cultivated, with the root called the aracacha. Those farther north are much lower, and adapted to the cultivation of tropical grains, roots, and fruits, as well as cotton, sugar, coffee, and tobacco. The low country which extends between the table-lands of Girona and Cucuta and the mountain-mass of S. Marta is mostly covered with extensive forests, and nearly uninhabited on account of its unhealthiness, which is caused by numerous swamps, frequent inundations, and almost continual rains. It contains the extensive lake of Zapatosa.

The Plains, or Llanos, of the river Orinoco comprehend the whole tract extending to the western banks of the Orinoco and to the Cassiquiare, between the Guainia, or Rio Negro, on the south, and the Apure river on the north. The northern part, as far south as the river Vichada, is a complete level, on an average 300 feet above the sea, near the mountains, and thence insensibly declining towards the Orinoco. It is quite destitute of trees, with the exception of a few palms, which occur at great intervals all over the plain. Along the river courses are some low bushy trees. The rainy season begins in April, and continues to the end of October. During this time the rain pours down in torrents, and is accompanied by violent thunder-storms, which generally occur two hours after noon. The dry season lasts from October to April, and during the months of December, January, and February, a cloud never crosses the sky. This extensive plain is quite unfit for cultivation, but innumerable herds of cattle and horses find here abundant pasture during the wet season, though they suffer much during the dry months. The mean temperature of the air is 80° Fahr., and the difference between the rainy and dry season amounts only to seven or eight degrees: the rainy season is the hotter. That portion of the plain which is south of the river Vichada is somewhat hilly in several places, especially between the rivers Guaviare and Guainia, where steep rocks rise a few hundred feet above its level surface. Its mean elevation above the sea is stated to be 480 feet. It is covered with immense forests, haunted by numerous wild animals: it is two or three degrees hotter than the level plain farther north, and its air is never agitated by a breeze. Rain descends every day, sometimes in torrents, sometimes like a dense mist, and the annual quantity is very great. Only the months of December and January are exempt from rain, but even then the sky is almost continually covered with clouds. The most south-eastern part of it, which is enclosed by the rivers Orinoco, Cassiquiare, Guainia, and Atabapo, may be called a woody desert, being entirely uninhabited, though covered with tall forest-trees. All this portion of the Llanos is extremely unhealthy, on account of the stagnant air and the vapours which continually rise from its rain-drenched surface. As for the rivers which drain the Llanos of Granada see ORINOCO.

As New Granada is situated near the equator, and presents such a great diversity in its surface, it is evident that within its boundary not only all the productions of the West Indies may be cultivated with success, but also those which are considered as peculiar to the temperate zone. We shall therefore limit our observations in this respect to a bare enumeration of those productions which constitute the commercial wealth of the country, or are likely to become objects of exportation. These are cacao, cotton, coffee, tobacco, indigo, rice, and sugar, of which however only the two first named commodities yield a considerable article of export. The forests furnish different kinds of dye-woods, as Nicaragua and Brasiletto wood, fustic, and logwood, which are mostly brought to the ports of S. Marta and Rio de la Hacha from the forest which lies at the back of these towns. To these may be added the Cinchona, or Peruvian bark, which is collected in some places near the sources of the Magdalena and Cauca. The numerous herds which pasture on the Llanos furnish hides and tasajo, or dried meat; horses, mules, and horned cattle are exported to the West Indies.

The mineral riches of New Granada are considerable, and mostly occur on the western declivity of the three chains of the Andes. They consist of gold, silver, platinum, mercury, copper, lead, iron, and rock-salt. Gold seems to occur along the whole western declivity of the Central and Western Andes, and is obtained by washing the sand of the rivers, or that on the foot and sides of some hills. In the Eastern Andes it is found only on the table-lands of Girona and Cucuta. The produce of gold seems to be on the increase, but has not yet attained the quantity which was got before the war of Independence. Silver occurs on the table-lands of Girona and Cucuta, but the produce is small; there are some richer mines in the mountain-region north of 5° 30′, between the Magdalena and Cauca. Platinum occurs only on the western declivity of the Western Andes. Mercury is found in the valley of Santa Rosa, near Antioquia, and in the Central Andes near the mountain-pass of Quindiu, between Ibague and Cartago. Copper occurs in the Eastern Andes, north of Tunja and near Pamplona, but it is not worked. Lead has been discovered in various parts of the Eastern Andes, but only one mine, near Sogamosso, is worked to any extent. Iron and coal are found in the mountains bordering on the table-land of Bogotà; some attempts have been made to work the iron-mines, and the coal is used in the smithies and for the

steam-boats. Rock-salt in large masses occurs in some mountains north-east of Bogotà, and is worked by the government. Some salt-springs in these mountains furnish annually between 6000 and 7000 cwts. of that article.

The population of New Granada consists of the descendants of the Spaniards who have settled there during the three last centuries, of some native tribes, and a few negroes. The Africans and their descendants were much more numerous before the war of Independence; but as they were the best soldiers that the country could furnish, the war has nearly annihilated that hardy race. To the destruction of the negroes also we think may be attributed the great decrease in the produce of agriculture and of the mines which has taken place since the termination of the war with Spain. The native tribes have attained very different degrees of civilization. Those inhabiting the table-lands along the Eastern Andes had before the arrival of the Spaniards formed a political society, and made some progress in the arts of civilization; they cultivated Indian corn and the aracacha-root. They are still the best husbandmen of the republic; and the Indian families living in the valley of the Upper Magdelena resemble them. In the valley of the Cauca there are no Indians. In the country between the Western Andes and the Pacific the native tribes constitute nearly the whole of its scanty population. They have made only small progress in civilization, and this little they owe to the Spanish clergy established among them. That portion of the Llanos which is destitute of trees is inhabited only by the descendants of Europeans, who take care of the herds of cattle, mules, and horses. The southern wooded portion of the Llanos is inhabited by different tribes of wandering Indians, still in the lowest stage of civilization, notwithstanding the exertions of the Catholic missionaries: such are the Maypures, Achaquas, Salivas, Guaicas, Otomacas, &c. The whole population of New Granada is estimated at 1,340,000 souls, of which about one half belong to the native tribes. The negroes amount to only a few thousands.

When it formed a part of the republic of Colombia, New Granada was divided into five departments. We are not aware whether a new division of its territory has been made since its separation, and we therefore notice that which existed before.

1. The department of Istmo, with a population of 80,000 inhabitants, comprehends the Isthmus of Panama with the contiguous province of Veragua.

2. The department of Cauca extends over the whole of the western coast from the Bay of Panama to Barbacoas, on the boundary of Ecuador, as well as over the valleys of the rivers Atrato and S. Juan, and of the Upper Cauca. Its principal productions are gold and platinum, the produce of its herds in the valley of the Upper Cauca, and cacao along the coast of the Pacific. In this department is the canal of Raspadura, which unites the S. Juan and Atrato rivers. [ATRATO.] It is divided into four provinces—Popayan, Choco, Pasto, and Buenaventura, and contains 190,000 inhabitants. The principal town is Popayan, situated not far from the sources of the Cauca river, and near the two volcanoes of Purace and Sotara. It contains 20,000 inhabitants, and several buildings much superior to those of Bogotà. The most remarkable are the bishop's palace and the Compañia or College of Jesuits, which has a large library well supplied with books, telescopes, and mathematical instruments. Being 5824 feet above the sea-level it enjoys a very mild climate, the thermometer never rising above 76°, and never sinking below 68°. Earthquakes are frequent. Farther north is Cali, in the vale of the Cauca, but at the foot of the Western Andes, a clean and well-built town, from which the most frequented road over the Western Andes leads to Buenaventura on the Pacific; but it cannot be used for beasts of burthen on account of its steepness. Buenaventura consists only of a few wretched huts built on posts, although it is the only port that supplies the valley of the Cauca and Popayan with merchandise, and has generally some foreign vessels, besides coasters, anchored there. Cartago, also in the valley of Cauca, has about 3000 inhabitants, and lies at the western extremity of the road passing by the mountain-pass of Quindiu over the Central Andes. Another road leads over the Western Andes to the towns of Novita and Citara, the former of which is situated on the S. Juan river, and the second on the Atrato. On the shores of the Pacific are the small harbours of Atacames and Barbacoas. In the Andes, near the boundary of Ecuador, is the town of Pasto, 8576 feet above the sea, on a fine plain, near the foot of a very active volcano. It contains about 5000 inhabitants.

3. The department of Cundinamarca (by which name the table-land of Bogotà was designated at the time of the Spaniards' arrival), contains the valley of the Lower Cauca, that of the Upper and Middle Magdalena, the table-land of Bogotà, and even a small portion of the Llanos lying about the sources of the rivers Guaviare and Meta. All the vegetable productions of New Granada may be cultivated here at different places, and the declivities of the Andes are covered with extensive forests. Gold and silver are found in the Central Andes; copper, lead, coal, and rock-salt in the Eastern Andes. It contains 370,000 inhabitants, and is divided into the provinces of Bogotà, Antioquia, Mariquito, and Neyva. The capital of the department and of the whole republic is Bogotà. [BOGOTA.]

The river Bogotà, which drains the plain on which the town is situated, forms, at a distance of eighteen miles to the south-west of it, in its descent from the table-land, the cataract of Tequendama, where the river, suddenly contracting from a breadth of 60 yards to less than 20, is precipitated in an immense body of water down a fall of 650 feet. In the same part of the table-land are the natural bridges of Icononzo, or Pandi, which unite two rocks, between which a torrent roars. The uppermost consists of a rock 47 feet long and 6½ feet thick, and is more than 300 feet above the surface of the water; the lower bridge is nearly 70 feet under the first, and consists of three pieces of rock, which support one another. In the valley of the Rio Magdalena is Honda, with 5000 inhabitants, on the banks of the river; and farther north, at some distance from it, Rio Negro, in a plain, with a population of 6000. West of Honda is Mariquita, a small town, near which are rich mines of gold. South of Honda is Neyva, with 4000 inhabitants; and still farther, near the source of the Magdalena, Timana, with 2000 inhabitants: both places are noted for their plantations of cacao. Gold is washed near Timana. Between Neyva and Honda, but at the foot of the Central Andes, nearly 4900 feet above the sea, is Ibague, which has a newly-erected college. Here begins the ascent over the mountain-pass of Quindiu, which terminates at Cartago, in the valley of Cauca. In the valley of Cauca are Antioquia, with 4000 inhabitants; and Medellin, in a fine valley, containing 9000 inhabitants. Medellin is the capital of the province of Antioquia.

IV. The department of Boyaca has obtained this name from the bridge of Boyaca, where Bolivar defeated the Spanish general Barreyra in 1819, by which victory the independence of South America was established. It comprehends the northern table-lands of Tunja, Girona, and Cucuta, and nearly the whole of that part of the Llanos which belongs to New Granada. It has some mines of gold and copper in the table-lands, and in the northern part of the Eastern Andes. Its population amounts to 450,000; and it is divided into four provinces—Tunja, Socorro, Pamplona, and Casanare; the last-mentioned province comprehends the Llanos. The capital is Tunja, on the hilly table-land of Tunja, near the Eastern Andes, with a population of 7000 souls, and some manufactures of woollen and cotton stuffs. Socorro, on the table-land of Sogamosso, has 12,000 inhabitants, and some manufactures of cotton and straw hats. On the table-land of Cucuta is Rosario de Cucuta, a considerable town, which carries on an active commerce in the products of the contiguous country, which is covered with plantations of cacao, sugar-cane, coffee, and cotton. Pamplona, which is in the mountains south of the table-land, has a population of 4000 inhabitants, some good buildings, and several mines in its neighbourhood, especially of gold. The capital of the province Casanare is Pore, a village situated on a branch of the river Meta. The small fortress S. Carlos is near the place, where the Cassiquiare falls into the Rio Negro.

V. The department of Magdalena comprehends the whole country east of the Gulf of Darien, and extending east to the boundary of Venezuela, not far from the Lake of Maracaybo. With the exception of the mountain-mass of S. Marta on the east, and the northern offsets of the Western Andes on the west, the whole of this department is rather level, and only contains some hilly tracts. Every kind of vegetable production peculiar to countries between the tropics is grown; but the heat and moisture of the cli

mate, which favour vegetation in an astonishing degree, are very injurious to the health of its inhabitants. It is thinly peopled, containing only 250,000 inhabitants, and is divided into the four provinces of Cartagena, Mompox, S. Marta, and Rio de la Hacha. The capital is Cartagena. [Cartagena.] South of this town is the Cienaga de Pasacaballos, a lagoon, where the canal (digue) of Malhates begins, which is partly artificial, and leads to the Rio Magdalena at Barancas-nuevas, a small town with little commerce. The canal can only be navigated by boats during the season of the heavy rains. Mompox, a town on the banks of the Magdalena, above its junction with the Cauca, carries on a considerable commerce, being the depôt for the produce of the table-land of Girona, and partly also of that of Cucuta. It contains 10,000 inhabitants. Ocaña lies east of the Rio Magdalena, near the Sierra de Ocaña, at a considerable elevation above the level country along the river, and has a healthy climate. The country about it is well cultivated, and the town has a population of 8000 souls. S. Marta, east of the Cienaga de S. Marta, and not far from the Nevado of the same name, has a good harbour, with some commerce, and 3000 inhabitants. Ciudad de la Hacha, farther to the east, has about 3000 inhabitants, and a small and ill-sheltered harbour. Along the coast west of this town pearls were formerly fished.

The manufacturing industry of New Granada is not important. It is limited to woollen and cotton stuffs of a coarse texture, only adapted for the use of the lower classes, and mostly made by the consumers.

The commerce of New Granada was much greater before its independence than it is now, a circumstance which is chiefly to be attributed to the effects of internal war during a period of nearly ten years, and partly to the unsettled state of its government since the expulsion of the Spaniards. The greatest part of the interior is unable to export its produce for want of roads and other means of communication. The tracts which border on the sea being mostly covered with swamps and morasses, and consequently very unhealthy, endanger the life of those who venture to traverse them. Not one of the more healthy provinces of the republic is so situated that it can send its produce without great expense to any one of its harbours, except the valley of the Upper Magdalena. The most fertile tract is the valley of the Upper Cauca, but this is everywhere surrounded by high mountains, and as the river becomes unfit for navigation on issuing from the valley, this district is obliged to convey its produce over one of the two great ranges which inclose it. Both however are so exceedingly steep as not to admit the use of beasts of burden; and all merchandise is carried over on the backs of men. The Western Andes being equally steep with the Central Andes, but much lower, the produce of the valley of the Upper Cauca is now commonly sent to San Buenaventura, owing to which circumstance this miserable place has risen to some importance.

New Granada was discovered by Alonso de Ojeda, who in 1499 sailed along the northern coast of South America to Cape de la Vela, and, in a subsequent voyage, to the Gulf of Darien. The first settlement was made at S. Maria la Antigua, on the Gulf of Darien, in 1510. The interior of the country was only conquered towards the middle of the sixteenth century, by Benalcazar and Ximenes de Quesneda, who founded the town of S. Fé de Bogotà in 1545. The Spaniards continued in possession of this country till 1811, when New Granada proclaimed its independence. The war, which was the consequence of this declaration, continued to devastate the different provinces of which New Granada consists to the year 1821. In 1819, New Granada and Venezuela being united into one republic, formed a constitution at the congress of Rosario de Cúcuta in 1821, and received into the union Quito and Panama in 1823. This union was dissolved in 1831, and the republic of Colombia divided into the three republics of Venezuela, New Granada, and Quito, or Ecuador. During their union these countries did not constitute a confederation of sovereign states, like the United States of America, but had one central government. We are not acquainted with the political changes which may have been introduced into it since that event.

(Juan and Antonio de Ulloa; Humboldt; Mollien's *Travels through Colombia; Letters written from Colombia; Present State of Colombia;* Hamilton's *Travels through the Interior Provinces of Columbia; Campaigns and Cruises in Venezuela and New Granada.*)

GRANADILLA, the name applied in Brazil to the fruit of the Passiflora quadrangularis, which is sometimes as large as a child's head, and contains in the centre of a thick fleshy rind a large quantity of seeds surrounded by a subacid pulpy mucilage. It is much esteemed in tropical countries as a pleasant dessert-fruit, and is occasionally seen at the tables of wealthy persons in this country. The fruit is easily ripened if the plant is trained under the glass at the back of a pine-stove.

GRANATUM. [Punica.]

GRANBY.—JOHN MANNERS, commonly called Marquis of Granby, eldest son of John, third duke of Rutland, was born January 2, 1720-21. Having entered the army, he raised a regiment of foot at his own expense in the rebellion of 1745; was appointed Colonel of the Horse Guards (Blues) in 1758; raised to the rank of lieutenant-general in 1759; and sent in the same year as second in command, under Lord George Sackville, of the British troops co-operating with the king of Prussia. Being present at the battle of Minden, he received the thanks of Prince Ferdinand of Brunswick in the following terms:—'His serene highness further orders it to be declared to lieutenant-general the marquis of Granby, that he is persuaded that if he had had the good fortune to have had him at the head of the cavalry of the right wing, his presence would have greatly contributed to make the decision of that day more complete and brilliant.' This however is not so much a compliment to the marquis as a reflection on his superior, who, as is well known, was accused of reluctance and dilatoriness in obeying orders to bring forward the British cavalry, and was ultimately broken for his conduct on this occasion. On Lord G. Sackville's resignation, the marquis was appointed to the chief command of the British troops, which he retained during the rest of the Seven Years' War, and both they and he gained honour at the battles of Warburg, 1760, of Kirch-denkern, 1761, and of Grabenstein and Homburg in 1762. After four years of warm service, he was rewarded with the post of master of the ordnance, in May, 1763, and in August, 1766, was promoted to be commander-in-chief. He resigned this office in January, 1770, and died much regretted on the 19th of October following, without succeeding to the dukedom.

He appears to have been a good soldier; brave, active, generous, careful of his men, and beloved by them; a valuable second in command, but not possessed of the qualities which make a great general. His popularity is shown by the frequent occurrence of his portrait as a sign for public-houses, even of late years, a fact which at once testifies in favour of his personal qualities, and indicates the low state of our military fame during the latter half of the last century.

GRAND BANK. [Newfoundland.]

GRAND JUNCTION CANAL. [Canal.]

GRAND JURY. [Jury.]

GRAND SERJEANTY, one of the antient English tenures. The tenant, instead of rendering to the king pure military service, was bound to perform in person some special honorary service to the king himself, as to carry his banner, or to be his butler, champion, or other officer at his coronation. It was in most other respects like knight service. Tenure by grand serjeanty still exists so far as relates to merely honorary services, but the burthensome incidents were taken away by the 12 Car. II., c. 24. (2 *Bl. Com.; Co. Lit.*)

GRANDEE. *Grande de España* is the name of the highest rank in the Spanish nobility. The grandees were originally the descendants of the great feudatories of the crown, but since the time of Don Carlos I. (Charles V. of Germany), who unceremoniously excluded them from the national assembly of the Cortes, it became the practice of the Spanish kings to raise new men to the rank of grandees, with the double object of rewarding their friends and at the same time breaking down the pride and influence of an order which was to them an object of jealousy. [Cortes.] This occasioned a distinction between the old and the new grandees, which was marked by the old ones addressing each other always in the second person singular, 'thou,' without distinction of age or official station; whilst they addressed on all occasions those of a recent creation by the title of 'your excellency,' which belongs to all Spanish grandees, with studied punctiliousness. The grandees considered themselves as superior in rank to all the other nobility of Europe, and only inferior to princes of royal

blood; but under the later absolute monarchs of Spain their chief privileges consisted in keeping their hats on in the king's presence and having military honours paid them by the guards at the royal palace. Many grandees had no other title; and there were many marquises and counts who were not grandees, and were addressed by the title of Vuestra Señoria, abridged Ussia. The younger brothers of grandees merely prefixed the title Don to their Christian name. Several of the grandees had, and some of them have still, enormous entailed landed property, such as the dukes of Medina Celi, Alba, Ossuna, Altamira, Infantado, &c.; they however never resided on their estates, but lived either at Madrid or in some of the provincial capitals, where they kept a sort of court with a numerous retinue of dependents, as it was customary for them to retain or pension all their servants for life. The duke of Arcos, who died in 1780, supported in this way no less than 3000 individuals. (Bourgoing, *Tableau de l'Espagne*, 1803.) The same custom prevailed among the great Roman and Neapolitan families; a servant once admitted was never turned out, except for gross misconduct, and after a certain term of service he was entitled either to a pension or to board and lodging in a building generally annexed to the mansion of the master, and which was called the 'palace of the family,' *famiglia* being the name given to the body of the servants. The political vicissitudes of the last forty years, by diminishing the fortunes of the great houses both in Italy and Spain, have altered these customs, which were a remnant of feudality. All the grandees of Spain, and also the Titulos de Castilla, or marquises with a Castilian title, had a right to sit in the old Cortes whenever the king pleased to convoke them, and they did so sit in the last Cortes assembled, in 1789, as the representatives of the estamento, or order of the nobility. The collective body of the grandees is called La Grandeza, but they have no political privileges under the present constitution, as there is no hereditary house of legislature at present in Spain.

GRANGE, LA. [LA GRANGE.]

GRANI'CUS. [ALEXANDER III., vol. i., p. 296.]

GRANITE, one of the most abundant rocks seen at or near the surface of the earth, and, from the variety of discussions to which it has given rise, one of the most celebrated. Wherever the stratified rocks, which were deposited by water, are seen to their very base, they are in all quarters of the world observed to rest on other *unstratified* rocks of the nature of granite. This rock appears in many instances to have been in a fluid state since the deposition of those strata which cover it, for it is seen to penetrate into their cracks and fissures, just as iron enters in veins the cracks of the sandstone which forms the sides or bed of the furnace. The fluidity of granitic rocks is now almost universally attributed, and, with sufficient reason, to the effect of great heat analogous in its origin to that which supplies the energies of volcanoes, but probably more general in its distribution and more uniform in its action.

It is impossible to say how much of the mass of the earth is composed of granitic rocks, though from the matter thrown up by volcanoes we see that mineral compounds in some degree analogous exist to considerable depths. To what extent it can be demonstrated that the sedimentary stratified rocks have been derived from disintegrated granites is yet uncertain, and Mr. Lyell has recently introduced the consideration of the more difficult question, whether granite has not been produced and may not still be forming by the remelting of such sedimentary aggregates into the general mass of the interior of the globe. The bare mention of such expanded views shows the high interest which attaches to the contemplation of granite. [GEOLOGY.]

Granite is one of the most beautiful of rocks, and viewed mineralogically its composition is remarkable. Mica, felspar, and quartz, in distinct crystals, or else filling interstices between crystals, constitute the typical varieties, and the most abundant masses of granite; but it is impossible so to limit the signification of the term. Hornblende must be included among the legitimate constituents of granite, if we are to use the term in a manner at all consistent with geological experience or the variations of granitic compounds. Other minerals, especially actinolite, chlorite, talc, compact felspar, steatite, garnet, zircon, &c., enter into and sometimes considerably modify the aspect of granite. The colours vary: the felspar is red, grey, yellow, white, green; the quartz is usually clear white or grey; the mica is black, grey, white, brown, and in various degrees silvery; the hornblende is dark green or black. The mica and felspar are invariably, and often (especially in cavities) beautifully crystallized; the quartz commonly fills the interstitial spaces left by these minerals, but small pyramidal crystals of quartz in great perfection may be sometimes seen imbedded in the faces of the prismatic felspar crystals, which are also sometimes penetrated by the filmy plates of mica.

Except in the veins which ramify into stratified rocks, and there grow fine-grained and even compact (like the base of some porphyries), granite, as its name implies, shows the grains of its component parts: the size of these varies extremely. The mica in the granite of Rubieslaw, near Aberdeen, forms laminæ some inches across; but in that of Cornwall, Skiddaw, &c., it exists in small plates; the felspar in graphic granite is almost one huge crystallized mass; large detached crystals in the granites of Shap and Ben Nevis make those rocks porphyritic, but in some of the building granites of Aberdeen all the ingredients are in small grains.

The proportion of the ingredients in typical granite varies greatly: the mica is sometimes absent, or replaced by hornblende. The following is a general view of the most remarkable granitic mixtures, to which some authors apply distinctive names, but we think with little advantage to geology. Some of these, mineralogically speaking, are identical with rocks of the trap family (Syenite), but certainly occur as parts of a granitic series, viewed geologically. (MacCulloch *On Rocks*.)

Binary Granite, composed of two ingredients: as felspar and mica; quartz and felspar; either equally blended (as in Muncaster Fell, Cumberland), or in segregated portions (as the graphic granite); quartz and hornblende (MacCulloch); felspar and hornblende.

Granite of three ingredients—(the typical varieties).
- Quartz, felspar, and mica, uniformly blended; or with distinct additional crystals of felspar, and then called porphyritic granite.
- Quartz, felspar, and hornblende. (Syenite of authors.)
- Quartz, felspar, and mica. (Instead of the mica, chlorite or talc sometimes appears.)

Granite of four ingredients:—
- Quartz, felspar, mica, and hornblende, or actinolite. (Syenite of some authors.)
- Quartz, felspar, mica, and compact felspar, or porcelain clay.
- Quartz, felspar, hornblende, and chlorite, or steatite.

GRANT (Concessio), in law, a conveyance in writing of incorporeal hereditaments, or of such interests in or arising out of land whereof no livery or actual tradition can be made. All corporeal hereditaments, as lands and houses, of which actual delivery can be made, are said to lie in livery; but advowsons, commons, rents, reversions, &c., which from their nature cannot so be transferred, are said to lie in grant. At common law, as at present, a writing was necessary to support a grant; the writing being the evidence of such transfer of property, as livery of seisin was in the case of a feoffment. Until the statute 4 Ann. c. 16, sc. 9, the ceremony of attornment was necessary in such grants of interests in reversion or remainder as are grantable; that is, the tenant in possession consented to the grant of the seignory, by which consent he became tenant to the new lord.

Attornment was a consequence of the feudal law, and until the ceremony was rendered unnecessary by the statute cited, and by another (11 Geo. II., c. 19), the doctrine relating to it was one of the most confused and difficult branches of the law.

The term grant is also applied to a transfer of goods and chattels, and to the contract to pay an annuity for a valuable consideration.

GRANTHAM, a borough and market-town in the county of Lincoln, 110 miles north by west from London. It is situated on the antient Roman road called Ermine-street, a little to the west of the river Witham, and is the principal town in the soke or wapentake to which it gives name. Grantham was at an early period the seat of a suffragan bishop, whom Sir Edward Coke (2 *Inst.*, fol. 79) calls the bishop's vicegerent; and at the time of the Norman survey it was held in royal demesne. The first charter of incorporation is that of Henry VI. in 1463. Other charters were granted by succeeding kings down to Charles II., at the close of whose reign the town was intimidated into the sur-

render of all its charters, of which it continued to be deprived until 1688, when the privileges of all municipal corporations were restored. The governing charter is that of 7 Charles I. The regular annual income of the corporation is about 400*l.*: the expenditure in 1832 exceeded 1200*l.*, though the average expenditure appears to be about 500*l.* Since the Municipal Act the borough has 4 aldermen and 12 councillors.

The boundary of the borough (2 and 3 William IV., cap. 64) comprises the parish of Grantham (including the townships of Spittlegate, Manthorpe, with Little Gonerby and Harrowby), and that portion of the parish of Somerby which is contained between the boundary of Grantham parish and High Dyke. The borough was first represented in Parliament in the 7th Edward IV., since which time it has continued to return two members.

The town is well paved and is lighted with gas. The principal public building is the church, which is a beautiful specimen of the Gothic style that prevailed in the thirteenth century, and is much admired for the height and elegance of its spire. In the interior are many curious monuments, for a description of which the reader is referred to Turnor's 'Collection for the History of Grantham,' 4to. Lond., 1806. The living is a vicarage averaging 100*l.* per annum, in the patronage of the prebendaries of the cathedral of Sarum. Grantham is connected with the Trent by a canal thirty miles in length, which is supplied with water by means of large reservoirs constructed for the purpose. It was commenced in 1793, and within five years the sum of 114,734*l.* had been expended on the undertaking. The trade consists principally in malt, corn, and coal: there is no manufactory of importance except a paper-mill. There are five fairs in the year for sheep and cattle, and a weekly market. In 1815 the annual value of the real property of the parish was assessed at 21,424*l.*, and in 1831 the population amounted to 7427, of which the town contained 4590 inhabitants. The free grammar-school of Grantham was founded by Richard Fox, bishop of Winchester, in 1528, and subsequently endowed by Henry VIII. The rents in 1833 amounted to 749*l.*, which were expended as follows:—The master received 150*l.*, the usher 130*l.*, the writing-master 90*l.*; 59*l.* were expended in repairs, and 330*l.* were paid as exhibitions to the university of Cambridge. It was at this school that Newton received his classical education previous to entering Trinity College, Cambridge. Woolsthorpe, about eight miles from Grantham, was his birth-place. The house, according to Dr. Brewster, was repaired in 1798, and a tablet of white marble put up to Newton's memory.

Besides almshouses and several charitable bequests for the relief of the poor, there is a charity-school founded by Mr. Hurst and two others, on the Lancasterian system, supported by subscriptions.

The *Soke* comprises the townships and hamlets of Barkston, Belton, Colsterworth, Woolsthorpe, Denton, Rochford, Easton, Gonnerby, Harbaxton, Londonthorpe, Great Ponton, and Sapperton.• The term soke, when applied to territory, is defined to be a district wherein the power or liberty to administer justice is exercised; and accordingly we find that the jurisdiction of the corporation of Grantham extends over the whole soke, within which the sheriff of the county has no authority whatever.

(*History of the County of Lincoln*, 4to. Lond., 1834; Turnor's *Collection; Corporation Reports*, &c.)

GRANVILLE, a town in France, in the department of Manche. It is on a headland projecting into Cancale Bay, at the mouth of the little river Boscq, 33 miles from St. Lo, the capital of the department. Granville consists of the upper town, and the faubourg or suburb. The upper town is on the summit of an eminence; the streets are irregularly built, dirty, and paved with pebbles: this part is the residence of the civil and military authorities. The faubourg or suburb is built on the south side of the eminence, and in the valley of the Boscq, by which stream it is divided into two equal portions. The streets of the faubourg are narrow and steep. The whole town is surrounded by a wall.

The port of Granville is adapted for small vessels only, and will not contain more than about sixty; yet the maritime importance of the place is considerable. Many vessels are engaged in the cod-fishery on the banks of Newfoundland and in the Gulf of St. Lawrence; the coasting trade is very actively carried on, and the dredging of the Cancale oysters employs many hands: fish and butter are salted in great quantity, and trade is carried on in corn, cattle, cider, timber, salt, and soda. There is one yearly fair. The environs of the town are fertile, and the Islands of Chaussey, which lie off this part of the coast, contain quarries of excellent granite. The population in 1831 was 7350. There are several public offices and a school of navigation; a church, an hospital, baths, and one public fountain. Granville is the only fortress on the coast between Cherbourg and St. Malo.

Granville is supposed to be on or near the site of an antient town mentioned in the 'Notitia Imperii,' under the title of Grannonum. The port was formed by the English when in possession of Normandie. In 1695 it was burned by the English; and in 1793 partially occupied by the Vendeans, who were however repulsed. In 1803, during the preparations of Bonaparte for the invasion of England, it was bombarded by an English squadron, but with little effect.

GRANULATION. [WOUND.]

GRAPE SHOT is an assemblage, in the form of a cylindrical column, of nine balls resting on a circular plate, through which passes a pin serving as an axis. The balls are contained in a strong canvas bag, and are bound together on the exterior of the latter by a cord disposed about the column in the manner of a net.

The dimensions of a column, or assemblage of balls, and the sizes of the balls in the column, vary with the nature of the ordnance from which they are to be discharged; according to the present method the grape shot are adapted to 6, 9, 12, 18, 24, and 32-pounder guns, but their weights are rather greater than those of the usual shot which correspond to each nature of gun.

A fire of grape shot is on service frequently directed against an enemy's troops when advancing in close order to an attack.

GRAPE-VINE. The grape is exclusively the produce of *Vitis vinifera*. The fruit of several other species of vitis, natives of America, especially *Vitis vulpina* and *Labrusca*, possess some merit as wine-grapes; but they bear no comparison with the long celebrated varieties of the Eastern species, and as dessert fruit they have still less claim to merit. It is however not improbable that they may yet become subservient in the cultivation of the grape-vine, by affording a hardier stock whereon the latter may be grafted in climates such as that of Britain, where the soil is colder than that to which the vine is indigenous, a circumstance which has not been hitherto sufficiently considered, but which is nevertheless of very great importance. By keeping in view its natural climate, as regards both atmospheric and terrestrial conditions, the treatment of the vine as an exotic may be comprehended in a few general and comprehensive rules, which will be far more useful than the numerous conflicting directions that are usually found in books on the subject; whilst the object of numerous others will be brought more clearly within the scope of general principles.

From numerous testimonies there remains no doubt as to the vine being a native of Greece, of Turkey in Asia, and of Persia. Sibthorp found it abundantly in a wild state throughout the Morea; Pallas met with it growing naturally near the Caspian and Black Seas; Olivier saw it in many parts of the mountains of Koordistan; Michaux found it also in the woods of Mazanderan; and on the opposite side of Persia a peculiar stoneless variety, the Kishmish, is in all probability a native of that part of the country lying on the Persian Gulf. Still farther east, on the northern shores of the Arabian Sea, it has been found in Beloochistan. It grows, in company with the olive and fig, along the bases of the Paropamisan mountains, extending to Caubulistan, where, with the apricot and peach, it seems as perfectly indigenous as in Anatolia and Karamania, and in these it grows wild in the heart of the forests. In Armenia it is known to abound; and as 'Noah began to be an husbandman, and planted a vineyard,' it may be inferred that this took place not far from Ararat, and that he found the plants, of course indigenous, at no great distance. Armenia, from its geographical position and mountainous surface, must possess an exceedingly varied climate; but it is only the lower slopes and valleys on the south side of the mountains that the vine can be supposed to inhabit; the mountains serving both for shelter from the winds blowing from the cold regions, and for reverberating the rays of the sun. The wines of Armenia are said to be poor; a warmer country must therefore be looked to for

a state of higher perfection. In Syria the grape succeeds so well that it has been by some considered its native country. For certain varieties the plains of Syria would be too hot; but all would find respectively a suitable climate in the varied temperatures of the mountain-slopes; so that, in common with other countries above named, Syria may be included in the range of the natural growth of the vine. In no country have grapes been produced equal to those of Syria, as regards the size of the berries and extraordinary weight of the bunches. At Damascus bunches are often found to weigh each from twenty to thirty pounds. This would appear incredible were it not for the corroboration afforded by an instance of horticultural skill in this country. In 1781 a bunch of the variety of thick-skinned white grape, called the *Syrian*, was grown by Mr. Speechly, at Welbeck, and weighed 19½ pounds. It was upwards of 21 inches in length, and 19 inches across the shoulders. A similar production has not since resulted from artificial means. Modern travellers relate having seen bunches of grapes in the mountains of Judæa which measured half an ell in length.

It therefore appears that the countries where the vine is most generally found indigenous lie between the 26th and 44th parallels of north latitude, and between the 26th and 75th degrees of east longitude. The distance between its southern and northern boundaries is upwards of 1200 miles; but it is probable that localities which it inhabits at the northern extremity of its range have not the full amount of cold due to their latitude; and the reverse may be likewise stated with regard to those situated at the southern extremity. Cultivation has extended it 10° in the open air on each side of the above natural range, but not with impunity, for its wood does not ripen in the highest latitude and within the tropics: for instance, in Hindustan it bursts its buds continually, and is deprived of that rest which its deciduous nature requires.

If we take the mean latitude of its indigenous range, and if we can ascertain pretty nearly what the atmospheric and terrestrial temperatures of that latitude are, we shall then be in possession of fixed data required for the due application of the arts of cultivation. The mean of 26° and 44° is 35°; and this parallel of north latitude runs through Syria, where the vine, as above mentioned, succeeds so exceedingly well. According to a table of the mean annual temperature for each degree of latitude, made out by Professor Mayer, of Göttingen, that corresponding to 35° N. lat. is 67° Fahr.; but it is to be regretted that a knowledge of the mean temperature of the different months for this latitude is not at present to be obtained. It will therefore be advisable to select such places as will approximate the nearest, and of which the temperature of the different seasons of the year has been determined. Accordingly if we take Rome, lat. 41° 53′, and Cairo, lat. 30° 32′, the mean of these latitudes will be between 35° and 36°, sufficiently near for our present purpose. Humboldt, from as many as 8000 observations, has determined the temperatures of these places to be as follow:—

Places.	Lat.	Mean Temp. of Year.	Mean Temperature of				Mean Temp. of	
			Winter.	Spring	Summer.	Autumn.	Warmest Month.	Coldest Month.
	° ′	°	°	°	°	°	°	°
Rome .	41·53	60·44	45·86	57·74	75·20	62·78	77·00	42·26
Cairo .	30·2	72·32	58·46	73·58	85·10	71·42	85·82	56·12
Mean .	35·57	66·38	52·16	65·66	80·15	67·10	81·41	49·19

It may be remarked that the mean temperature of the above places, deduced by Humboldt from numerous accurate observations, agrees with the calculation of Professor Mayer, for a latitude equal to the mean latitude of these places, to within the tenth of a degree of Fahrenheit's thermometer. Gradations of temperature similar to those in the above average of the climates of Rome and Cairo, and corresponding with that of lat. 35° or 36°, will ripen the largest varieties of those called hothouse grapes, and which absolutely require the heat of a stove to bring them to full perfection, such as the Muscat of Alexandria, and the Syrian, or Black Morocco.

In forcing the vine in this country the directions given by the best authorities, from the result of long experience, agree with the natural condition of the vine in this respect, as exhibited in the above table, tolerably well as regards temperature. Some variation is necessary according to the season at which the forcing of the vine is commenced, which is sometimes in the depth of winter, and certain varieties require a stronger heat than others. Generally speaking, the following directions are proper:—Commence at 50° or 52°; increase gradually, but not exceeding 60°, till the buds are expanded and bursting into leaf, for if the temperature were suddenly raised to any considerable extent, only the buds at the extremities, the most excitable, would break; thus leaving the vines naked, as it is termed, at the bottom. When the buds have burst, and the leaves are a little developed, the temperature may be raised from 60° to 65°, progressing to 70°; and when the bunches are formed and the bloom about to expand, 75° will not be too much, and this should be continued, as the minimum, till the fruit is ripe. By sun-heat the temperature may be safely raised as high as 80° or even 90° in the summer season, provided that fire-heat is not in use at the same time. Air should be freely admitted; but one mal-practice it is necessary to guard against: sometimes the sun raises the temperature of the house very high when the latter is shut up close, and this will often happen when the external air is very cold; ventilation is suddenly and extensively employed without reference to the outside temperature: as soon as the heated air of the interior gets vent, it rushes out in consequence of its greater elasticity, and its place becomes instantly supplied with that from the exterior, the chilling effects of which must be sufficiently obvious. In giving air, the *temperature of the house should never be lowered in consequence;* that is to say, it should be given in time to *prevent* the accumulation of too much heat, and not used in order to disperse it, after the heat has, by neglect, been allowed to accumulate to too great a degree. Unavoidable circumstances will in practice sometimes interfere with the strict observance of this rule. In such cases, as far as the vine is concerned, there will be comparatively less danger in giving air only sufficient to prevent the temperature ascending still higher, than by giving it in such quantity as to produce forthwith a sensible diminution.

The air of the house should be kept moist, except when the fruit is ripening. The syringe may be used for the branches and leaves from the commencement of forcing till the fruit begins to colour, excepting whilst the fruit is in bloom. Recourse should also be had to steaming, and this more especially when the fruit is setting. In every country, except perhaps the hot sandy deserts, the atmosphere is *moist at night;* but what is the state of the vine, subjected to early forcing, the walls whitewashed, the floor paved, except where the flues occupy a considerable space? Supposing the temperature of the air in the house to be 75°, and that of the external air 32°, or lower, all the moisture contained in the atmosphere of the house will, under such circumstances, be quickly condensed by the coldness of the glass: the air thus deprived of its moisture cannot certainly derive a fresh supply from such surfaces as lime and hot flues. If tried by the hygrometer (Daniell's), as much as 20° of dryness will be exhibited, or what would constitute a very dry day in summer. It is therefore surprising that the vine, subjected to this inverted order of things, a very dry atmosphere at night instead of a moist, and drier at night than during the day, should even set its fruit so well as it does. The evil should be partially remedied by pouring water on the floor, if there be no bed of soil within the house; and if there be, the bed should be stirred on the surface and watered, but not with water of low temperature. It may also be remedied in a great measure by using such means as will mitigate the cause, that is, the coldness of the glass; for if the latter were of an equal temperature with the air in the interior, no condensation could take place, at least from this cause; and consequently the vapour would remain suspended throughout the atmosphere of the house. If therefore a covering were fitted so as to be easily rolled down in cold nights, the effects would be most beneficial in more respects than one; for, in the first place, the glass would be deprived of its condensing property in proportion to the greater heat which it would retain; and with regard to the saving of fuel the advantage would be considerable, in consequence of the prevention of radiation by the glass. In many parts of the country where fuel is dear the expense of the covering in the first instance would ultimately prove a saving. By the wealthy this advantage would be but little esteemed, compared with the greater one which would also result from the adoption of the mode of protection recommended, that of having their vines exhibiting a fresh and

healthy foliage, instead of being disfigured by the red spider, which a dry atmosphere tends to encourage.

The atmospheric conditions necessary for the perfect growth of the vine have now been explained, both as regards temperature and moisture; and the deviations most likely to occur in the practice of cultivation have likewise been pointed out.

The next point is the terrestrial condition of the vine in natural circumstances. It is to be regretted that the data at present obtainable for this purpose are not so exact as could be wished; nevertheless, it is probable that what do exist are so near the truth, that the deductions will be sufficiently correct for practical application.

It is known that the mean temperature of the earth differs little from that of the atmosphere above it; therefore the most favourable climate of the vine, about lat. 35°, will have a mean terrestrial temperature of 67°. In spring, when vegetation begins in the vine, it may be estimated at not lower than 60°. By the time the bloom expands it will have reached 70°, or nearly so; and 80° will certainly be within the limits of its summer temperature. It has been shown that in forcing the vine in this country the atmospheric temperature of the above climate is pretty closely imitated: let us now compare that of the soils. The mean temperature of the earth in the climate of London is about 51°, from which that of spring-water differs little throughout the year. In winter, when early forcing of the vine is commenced, the border in which the roots are extended will sometimes be below 40°, and if we even say 45°, whilst the vine has its branches and blossoms in a temperature of 75°, still we have a disparity of 30°! These conditions are not by any means transient, for the earth retains its state of winter cold till late in the spring. In summer, from the greater length of the days at this season than in more southern latitudes, the earth acquires a tolerably high and nearer corresponding temperature; but before this occurs the crop of grapes has received checks which more favourable circumstances cannot remedy.

To this disparity of temperature between the root and the top of the vine may be certainly ascribed the *bad setting*, *spotting*, and *shrivelling* of grapes. There is another evil which may perhaps be mistaken for the contrary; when the shoots are in a well-regulated warm and moist temperature, they will become bearded with rootlets feeding on the genial moisture of the atmosphere of the house; and they do increase the growth of the shoots above them considerably for a time, as will appear evident from the shoots being thicker at the top than at the bottom; but these aërial roots prove a deceitful source of nourishment, for they wither when the weather becomes dry, and the roots are not prepared to supply the deficiency. Shrivelling of the berries is one bad consequence likely to ensue; it is therefore better to pinch them off as they appear, and let the sap endeavour to find its way to the roots. Had the latter been in a genial soil and temperature, the vine would not have shown such a disposition to emit roots above the ground, therefore the remedy is to be sought in a reformation of the border.

In the formation of the vine-borders, all agree that they should be effectually drained. Draining may be badly performed with much labour and plenty of materials; for instance, it is of no use to run a drain in one direction when the communication of land-springs, or the gradual soaking from such, is not completely cut off in others. The latter should be provided for in the first instance by a drain all round the site of the border, and deeper than the lowest roots of the vine. A good bed of stony materials should then be laid all over previous to the soil being placed upon it; and if these materials were made to rest on a layer of composition, such as is now very generally used for a bed for the foundation of walls (composed of powdered unslacked lime and gravel, worked together with water on the spot), the bed would thus be rendered perfectly secure from any influx of water, either by the sides or bottom, the communication with regard to the former being intersected by the surrounding main drain, and the bottom rendered completely impervious by the stratum of *concrete*. When the latter is dry, or *set*, as it is technically expressed, the stratum of stones, to the depth of at least six or eight inches, may be laid on. Some dried heath, or tough turf with the green side downwards, should be laid over the stones to prevent the soil from mixing with them. Should the depth of drainage here recommended be greater than that for which a proper declivity can be obtained, a tank must be formed at some convenient distance, and kept below the level of the drainage by occasional pumping. If land-springs fall into the surrounding drain of the border so as to render this process by any means tedious, the drain must be built close, excepting immediately above the level of the concrete basement of the border, where openings of dry brickwork should be made opposite the stratum of loose stones.

The nature of the soil of which the border is now to be composed should consist chiefly of rich fresh, or maiden loam (which should be strong yet friable, so as to be at all times pervious to water), a portion o rotten dung, some lime, or other calcareous substance, such as shell-marl, old lime-rubbish, and, by all means, bone-dust, than which nothing is better. The whole should be well mixed, and the dung more especially should not remain in masses; for if the roots should find it so, they will, in the first instance, strike readily into it, but after two or three years it becomes inert, if not vitiated, and is thus productive of injury to the parts solely in contact with it. A soft muddy sand is sometimes found in the beds of rivers, in which the vine thrives very well; a portion of such may be mixed with the composition of vine-borders when it has been proved to contain no deleterious ingredients. The depth of soil when first put in need not exceed three feet, so that when settled it will be about two and a half; and its surface should slope a little from the front wall towards the walk; and seeing that it is isolated from water existing in the earth by drainage and other means above described, it should not be raised too high; otherwise, from the requisite top-dressing, the borders assume in the course of several years the appearance of an embankment. The vines must not be planted deep. A furrow should be drawn six inches deep, at right angles from the wall, to the distance of two or three feet; at this distance the root, after being turned out of the pot, should be placed, and the stem or shoot laid along the bottom of the furrow, and carefully introduced at the opening left in the front wall for its reception. The portion of shoot thus buried will emit a number of vigorous roots near the surface; and such as are found so situated ought to be on all occasions preserved and cherished in this comparatively cold climate.

The vines being planted in a border of suitable soil, reposing on a thoroughly drained bottom, and their tops introduced into a perfectly natural temperature, presuming that the directions given in this respect have been attended to, it is next to be inquired, whether the roots are in a correspondingly natural condition? Although the answer cannot be given absolutely in the affirmative, yet a considerable approximation to a natural state of things will have been effected: firstly, by cutting off the land-springs, with the cooling effects resulting from their 51° or 52° of temperature (perhaps lower than this in the end of winter); secondly, by having rendered the soil of the border pervious, and resting it on a stratum completely so; the consequence of which is that the first warm rains will readily descend, and communicate their temperature to the soil throughout, from top to bottom, whence the superabundance will retire subterraneously through the channels provided for that purpose, and thus give place to the successively warmer rains of the advancing season. Hence, in May or June, if rain should fall at 60°, we shall have the bottom of the border at that temperature, instead of 52°. This acquisition will not be lost upon the vine, and the latter will exhibit still more beneficial effects from the same salutary cause in proportion to the increasing temperature of the succeeding months; and when with this is conjoined the direct effects of the sun's rays on the border, heightened also by their reverberation from the glass roof, the condition of the roots of the vine thus circumstanced will be tolerably natural in the summer season.

Precautions of this kind are however of little effect in regard to the early period of forcing, when the borders are exposed to the chilling effects of frost, snow, and cold rain. These must be guarded against by other means. When either frost or snow has taken possession of the surface of the border neither of them should be buried in it, otherwise a very great proportion of heat will be abstracted from the soil before they are thawed. Even the descent of rain a little above freezing will have very deleterious effects. Under any circumstances the border should be covered with hot dung; and if the latter could be more effectually protected

from the cooling influences of the agents above mentioned, a great point would be gained. This might be done at no great expense, by constructing a slight moveable roof, its ridge being above the middle of the border, and running parallel to the front wall. The pitch of elevation need not be so high as to interfere in the least with the influence of the sun's rays on the glass. The covering may be a tarpauling; the eaves conducting the rain or melted snow into the gutter at the front wall on the one side, and into the drain by gratings on the other. The south side might be made so as to roll up in warm sunny weather during the day, and to cover closely down at night in order to prevent the escape of heat by radiation; and as light is by no means essential to the roots, the covering may be kept close both night and day, provided that more heat is thereby economized. The border would thus be completely sheltered from the rain, and, in a great measure, from the cold; but artificial watering will become necessary. This however must not be done with cold water, for if so the above precautions will be rendered useless. It will be an easy matter to bring all the water requisite at this early period of the season to a temperature of 70°. If the first watering be made to pass through the hot dung, when the latter is first laid on the border as a mulching, the forcing may be immediately commenced without fear of any danger arising in consequence of an unnatural disparity of temperatures between the roots and tops of the vines. These, it is necessary to observe, should not be in a temperature exactly corresponding in the early part of the season; the roots should be several degrees lower, inasmuch as the earth is colder than the atmosphere till after the summer solstice. This must be the case even in Syria (the climate of which country, as more than any other favourable for the vine, it is our business to imitate); but there, of course, the difference between the mean temperature of the earth and atmosphere at different seasons will be less than in Britain, because the winter and summer temperatures of the latter differ from the annual mean to a much greater extent than those of Syria.

All contrivances of this kind for keeping borders dry are however expensive and unsightly. It is therefore better for early forcing that the vines should be planted inside the house. A vine so planted in 1758 at Valentine House, in Essex, produced annually upwards of three hundredweight of fruit, and in some seasons upwards of four hundredweight. This may reasonably be ascribed to the soil in which its roots were situated being of a genial temperature, from being not only protected from such effects of cold agents as are above recommended to be averted, but also from receiving heat from the atmosphere of the house. Inside planting is the more advisable now that a greater area for vines to grow in can be obtained, in consequence of the mode of heating by hot water, which renders a large space formerly occupied by flues available for the extension of the roots of the vine. The same care is necessary in draining and otherwise forming the bottom and substance of the border inside, as was recommended for the outside. The roots of vines may be always had in abundance near the surface, if the mulching be not disturbed during the summer.

The *propagation* of vines is easily effected by *cuttings*, *layers*, and *grafting*. Where bottom heat can be commanded, cuttings consisting each of only a *single eye* are to be preferred. These are at first to be placed in very small pots, and successively shifted into larger as their roots require it. Their leaves should be exposed to plenty of light, and by proper attention the shoots may be grown twenty feet in length in one season.

Grafting the vine requires to be performed at a particular stage of its vegetation. If it be done when the sap is not in motion, as may be proper in other subjects, the wound will *bleed*. The vine to which the scion is to be united must therefore be allowed to be in leaf, and the young shoots several inches in length. Opposite one of these the scion is fitted [GRAFTING]; and the clay should be covered with moss, and kept moist. When the buds of the scion have begun to expand into leaf, the shoot of the stock opposite to the scion must be stopped, and soon after shortened back to one leaf.

The *pruning* of the vine should be performed as soon as the wood is perfectly matured in autumn, if early forcing is intended; and in all cases, on walls or elsewhere, the operation should not be delayed later than the beginning of winter. Various methods are adopted in pruning: some cut the shoots almost close to the old wood; others leave it in spurs of the length of several buds, and some cut out a portion of the old wood every year, so as to leave room for a succession of young shoots. The latter mode is technically called the *long cut;* and by adopting it the largest bunches are produced. *Short* or *spur* pruning is chiefly used by fruit-growers for the markets, as the bunches can be had in greater numbers and of a size better suited for the wants of their customers. The vine in fact may be trained in any fashion, provided that the bearing wood is at regular distances, and not anywhere crowded.

No more wood should be laid in than can have a sufficient share of light for the leaves which such wood produces. As a general principle, nothing can be said in addition to this as regards the chief object of pruning. In summer all shoots that are not likely to be required in winter must be *stopped*. Those on which there are bunches should, according to some writers, be stopped immediately at the bunch; others leave one *joint* or bud beyond the bunch, and some two; but one is quite sufficient, unless wood is required to fill a vacancy. After being first stopped, the shoots will again push, and will require to be pinched back to within one bud of the place where they were formerly shortened.

The berries should be thinned as soon as they are formed of the size of small peas; and in so doing the interior ones should be cut out. If a small portion of the lower extremity of the bunch be cut off at this period, the part left will have finer and better-swelled berries.

(For a list of sorts of Grapes see FRUIT.)

GRAPSUS, GRAPSUS TRIBE, GRAPSOIDIANS, a natural group of brachyurous crustaceans, belonging to the family of *Catametopes*, placed by M. Milne Edwards between the *Gonoplacians* and the family of the *Orystomes*, and approaching, in his opinion, nearer to the tribe of *Gonoplacians* than to the *Ocypodians*. He gives the following as the characters of the Grapsoïdians:—

Carapace, in general, less regularly quadrilateral than in the *Gonoplacians* and *Ocypodians;* its lateral borders are nearly always slightly curved, and its fronto-orbital border frequently does not occupy more than about two-thirds of its transversal diameter. The *body* is nearly always compressed, and the *sternal plastron* but little or not at all curved from before backwards. The *front* is nearly always strongly recurved, or rather bent down, and very wide, occupying about the half of the anterior border of the carapace, and exceeding on each side the edge of the lateral borders of the buccal frame. The *orbits* are oval-shaped and of moderate size; and the lateral borders of the carapace are slightly curved and nearly always trenchant. The *ocular pedicles* are large and short; their insertion is below the front, and the *cornea* occupies one half of their length. The *internal antennæ* are sometimes vertical and lodged in distinct pits ('fossettes'), which are open at the upper surface of the carapace; but in the great majority of instances these organs are entirely transversal and completely covered above by the front; their terminal stem is nearly always of the ordinary length, and terminated by elongated and multiarticulate appendages which are very distinct. The *external antennæ* here fill the gap which exists between the front and the inferior orbital border, and which forms a communication for the antennary pits with the orbit. Their first joint is nearly always short, but rather large, and nearly entirely covered by the front. The three following joints and the terminal stem are very little developed. The anterior border of the *epistome* is always placed on the same line as the inferior border of the orbit, with which it is continuous. The *buccal frame* is but little or not at all narrowed in front, and the terminal stemlet of the *external jaw-feet* always springs from the middle of the anterior border, or from the external angle of the preceding joint, and is never hidden below it. The *palp* of these jaw-feet presents nearly the same form as in the crabs; it is large and terminated by a multiarticulate appendage bent back inwards under the third joint of those members. The *sternal plastron* is not very wide backwards, and gives insertion to the intromissive organs. The disposition of the feet varies; those of the first pair are in general short, and those of the four last pairs are very much compressed; these last are sometimes natatory, a character which is not met with in any other crustacean of this family. The *abdomen* is composed of seven joints, and its second articulation

extends nearly always, in both one and the other sex, as far as the origin of the posterior feet. The *thoracic branchiæ* generally amount to seven on each side. The *epimere* of the last thoracic ring is nearly as much developed as that of the preceding ring, and concurs to form the vault of the flanks; thus the superior, or epimerean cellule of this penultimate ring does not cover the cellule which corresponds to the posterior foot, as is the case in the *Gecarcinians.*

Habits.—The greater numbers of the tribe, as far as the manners of the crustaceans composing it are known, live on the shore, or on the rocks which border the coasts; they are very timorous, and run away with much swiftness.

M. Milne Edwards, who gives the above definition and account of the Grapsoïdians, divides the tribe into seven genera, viz.:—

Sesarma. (Say.)

Carapace quadrilateral, nearly equilateral generally, and very much elevated in front; fronto-orbital border occupying its whole width; lateral borders straight, and posterior border very long. *Front* nearly always suddenly bent down and its length very considerable, exceeding half of the transversal diameter of the carapace. *Eyes* large and of moderate length; *orbits* inclining to oval, with generally at their external angle a large gap, which is continued with a horizontal gutter situated immediately below the lateral border of the carapace, a character found in *Macrophthalmus*, but which does not exist in the majority of the *Grapsoidians;* lower border of the orbit horizontal and directed forwards: a very strong tooth is directed towards the front from its internal part. *Antennary pits* transversely oval, and the space which separates them generally very large. Basilary joint of the *external antennæ* more or less cordiform, giving insertion to the succeeding joint in a notch situated in the middle of its internal border; its width is considerable, although the front exceeds it laterally. *Epistome* very short and projecting, like all the surrounding parts; it is continued with the inferior orbitary border, and below that border there is a horizontal gutter which terminates at the angle of the buccal frame; there are also other furrows under the *pterygostomian regions* the surface of which is granulous or reticulated; it is generally divided into small squares of great regularity, and this character alone would suffice to distinguish the greater part of the species of *Sesarma* from nearly all the other *Catametopes*. The disposition of the *external jaw-feet* is also very remarkable; for there is always a wide lozenge-shaped space between them, and their third joint longer than it is wide, and longer than the second, is rather oval, and but little or not at all truncated anteriorly. It is also to be noted that there exists on the surface of this lamellar portion of the external jaw-feet a projecting line or crest which is carried obliquely from its external and posterior angle to its interior (anterior?) and internal angle; this crest is generally furnished with hair, and there is a deep furrow near its external border. The *sternal plastron* is generally convex from behind forwards, and in the male the anterior portion of the cavity which receives the abdomen is rounded and surrounded with a small border. The *anterior feet* of the *male* are nearly always much longer than those of the second pair, and terminated by a strong and convex hand. Sometimes it is the same with the *female*. The feet of the second pair are shorter than those of the third, and terminate, like all the succeeding feet, by a large rounded styliform joint which is more or less distinctly canaliculated, generally downy, and almost always completely devoid of spines. The second ring of the abdomen is in general nearly linear, and the last is much more narrow at its base than the penultimate ring, so that at this point the abdomen is abruptly narrowed. In the *female* the last joint of the abdomen is very small, and in general lodged almost entirely in a notch of the preceding ring.

Geographical Distribution.—The genus is found upon the coasts of America, Africa, and Asia.

Mr. Say, who first separated these crustaceans under the generic name *Sesarma*, afterwards reunited them to *Grapsus;* but M. Milne Edwards, who has entered into the details of the construction of *Sesarma* above given, in order to point out its distinctions, is of opinion that it ought to be distinguished, and to be considered as constituting the type of a rather numerous genus, which the latter divides into the following sections:—

A. Species whose carapace is at least as wide as it is long, and but little or not at all narrowed posteriorly.

a. Lateral borders of the carapace armed with two or three teeth (comprising the external orbital angle). Body very thick, especially before.

Example, *Sesarma tetragona* (*Cancer tetragonus?* Fabr.; *Cancer fascicularis*, Herbst; *Ocypode tetragona*, Olivier; *Grapsus tetragonus*, Latreille). Length 28 lines. *Locality*, Indian Ocean.

a a. Lateral borders presenting no tooth behind the angle of the external orbit. (Body depressed.)

Example, *Sesarma quadrata* (*Cancer quadratus*, Fabr.; *Ocypode plicata*, Bosc.). Length 8 lines. *Locality*, the neighbourhood of Pondicherry.

B. Species whose carapace is much longer than it is wide, and strongly narrowed backwards.

Example, *Sesarma Pisonii* (*Arata pinima* of Piso). Length 8 lines. *Locality*, the Antilles. M. Milne Edwards says that Latreille has confounded this species with *Grapsus cruentatus*. M. Milne Edwards is also of opinion that *Grapsus Husardii* (Desmarest) and *Cancer Hispanus* (Herbst) belong to this genus.

Cyclograpsus. (M. Edwards.)

Body much less flattened than in *Grapsus* and wider, the transversal diameter of the carapace much exceeding its length. *Front* inclined but far from being vertical. Lateral borders of the shell elevated, delicate, and very much curved, and its lateral walls forming ordinarily a nearly straight angle with its upper surface. *Eyes* nothing remarkable; *orbits* directed forwards and presenting almost always below their external angle a wide and deep notch, which, as in Sesarma, is continued backwards with a transversal gutter hollowed out in the pterygostomian regions of the carapace below its lateral border. *Antennary pits* much less narrow than in *Grapsus*, and the basilary joint of the *external antennæ* much less wide. *External jaw-feet* much resembling those of *Grapsus:* their third joint shorter than the second, wide as it is long, enlarged anteriorly and strongly truncated at its anterior border; a small projecting and piliferous crest runs obliquely from the anterior and interior angle of this joint to the posterior and external angle of the preceding joint, so as to form with that of the opposite side a triangle, the base of which is backwards; the external appendage of these jaw-feet nearly reaches the anterior border of the third joint of their stem, and terminates by a multiarticulate appendage. *Feet* of nearly the same form and disposition as in *Grapsus*, except that the tarsus is not so large, and has no spines.

Geological Distribution of the genus, the seas of Asia exclusively (M. Edwards).

M. Milne Edwards divides the genus into the following sections:—

A. Species having the lateral border of the carapace entire.

a. A deep gutter springing from the external orbital gap and directed forwards.

Example, *Cyclograpsus punctatus*. Length, 15 lines. *Locality*, the Indian Ocean.

a a. No well marked post-orbital gutter.

Example, *Cyclograpsus integer* (*Grapsus integer*, Latreille). Length, 4 lines. *Locality*, Brazil.

B. Species the lateral border of whose carapace is dentated.

b. External orbital gap but little marked. Orbits directed forward.

Example, *Cyclograpsus quadridentatus*. Length, 10 ines. *Locality*, New Holland.

b b. External orbital gap very wide. Orbits very oblique.

Example, *Cyclograpsus Latreillii* (*Grapsus venosus*, Latreille). Length, 4 lines. *Locality*, the Isle of France.

Pseudograpsus. (M. Edwards.)

M. Milne Edwards observes that one of the characters pointed out with reason by M. Latreille as distinguishing the natural groups of *Grapsus* and *Plagusia* is the having the external jaw-feet narrow and notched on their internal border, so that these organs, instead of closing the mouth completely, leave between them a vacant lozenge-shaped

space: but he remarks that this disposition is not met with in all the species which are usually arranged under the genus *Grapsus;* and as these modifications of the buccal apparatus coincide with other characters, and seem to indicate a natural division among these animals, he has taken it as the basis of their classification, and proposes for those walking Grapsoïdians whose mouth is completely closed by the external jaw-feet the name of *Pseudograpsus*, with the following generic character:—

General form approaching that of *Cyclograpsus* more than that of the other Grapsoïdians, the *body* being thick, and the carapace, convex above, being rather regularly rounded on the sides. Basilary joint of the *external antennæ* nearly square and joined to the front, its external border being in contact with a vertical tooth which elevates itself on the floor ('plancher') of the orbit, as in *Macrophthalmus* and the *Ocypodians*. Internal border of the second and third joint of the *external jaw-feet* straight, and this last joint, remarkable for being much wider than it is long, presents in the middle of its anterior border a notch whence springs the terminal stemlet ('tigelle'). *Sternal plastron* nearly circular, and slightly curved from before backwards. Anterior *feet* of the male very large, and much longer than any of the succeeding feet, which are rounded and terminated by a hairy tarsus, and completely deprived of spines. *Abdomen* of the male not extending quite to the base of the posterior feet, and its second joint linear.

Geographical Distribution of the genus, the Asiatic seas.

Example, *Pseudograpsus pencilliger* (*Cancer setosus?* Fabricius; *Grapsus pencilliger*, Latreille). The feet are

Pseudograpsus pencilliger.

rounded and furnished with a thick-set down. Length, rather more than an inch. *Locality*, seas of Asia.

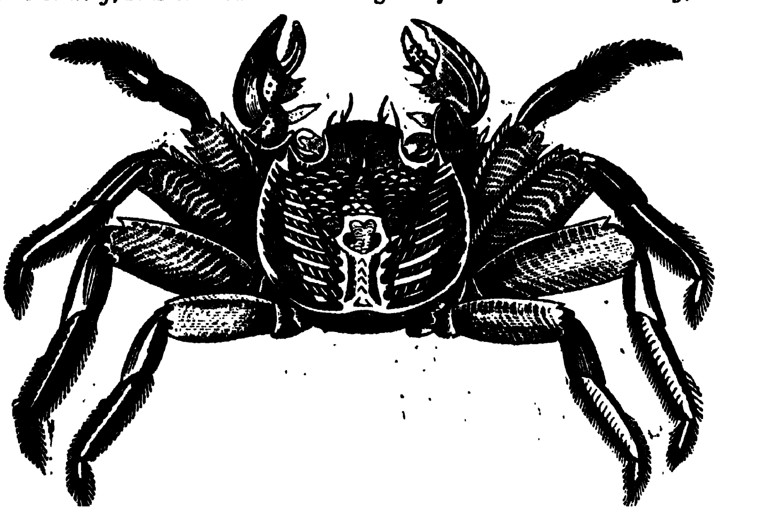
Grapsus. (Lamarck, in part.)

M. Milne Edwards retains in this genus those species which are, for the most part, remarkable for the extreme flatness of the body, and present the following characters:—Upper surface of the *carapace* always nearly horizontal and nearly square; its anterior border rarely occupies its whole width, but the difference is not considerable, and in general its posterior part is not narrowed,—the lateral borders are delicate, and ordinarily a little curved. *Stomachal region* very large, and *branchial regions* very extended, and nearly always marked with salient oblique lines. *Front* very wide, and inclined or even completely bent down; the upper part, in general, divided into four lobes, which often become very projecting. *Orbits* deep, and their inferior border at least as salient as the superior border, but the external extremity does not open into a horizontal gutter situated under the lateral border of the *carapace*, as in *Sesarma*, and presents one or two small notches at most; the tooth which elevates itself from their lower wall, beneath the articulation of the eye, is in general very strong. Disposition of the *antennæ* nearly the same as in the preceding genus, except that the antennary pits are in general less wide, and separated by a narrow space between them. *External jaw-feet* strongly notched within, so as to leave between them a large vacant lozenge-shaped space; their third joint is trapezoïdal, and terminates anteriorly by a straight and very wide border; it is in general nearly of the length of the second joint, and carries the succeeding joint at its external angle, but it is sometimes very short, strongly dilated on the external side, and gives insertion to the fourth joint towards the middle of its anterior border.* *Pterygostomian regions* smooth, or very slightly granulous, and never presenting the disposition so remarkable in *Sesarma*. *Feet* of the first pair short, the *arm* enlarged and spiny within, *hands* short but rather stout in the males. The succeeding feet remarkably flattened; their third joint entirely lamellar below in its external moiety, its superior border delicate and elevated, and the tarsus large and very spiny. Second pair of feet much shorter than the third, which, in their turn, are in general much shorter than the penultimate feet. *Abdomen* of the *male* triangular; that of the *female* very wide, its last joint large, and not inclosed in a notch of the preceding joint as in *Sesarma*.

Geographical Distribution of the genus.—*Grapsus*, as above modified, is spread over nearly all parts of the world. The known species generally inhabit rocky coasts, and run with great rapidity.

A. Species having the third joint of the external jaw-feet longer than it is wide, and without any remarkable dilatation towards the external angle.

Example, *Grapsus pictus* (*Pagurus maculatus*, Catesby; *Cangrejo arrecife*, Parra; *Cancer tenuicristatus*, Herbst; *Cancer grapsus*, Fabricius; *Grapsus pictus*, Latreille). Length rather more than 2 inches. Colour red, with irregular yellow stains. *Locality*, the Antilles.



Grapsus pictus.

* M. Milne Edwards here observes that if it were not for fear of over multiplying generic divisions among the animals which resemble each other strongly, one might avail oneself of this character to separate from *Grapsus* those species which form his second section of the genus.

Catesby gives the following account of the habits of this species under the name of *Pagurus maculatus, the Red-mottled crab*:—'These crabs inhabit the rocks hanging over the sea; they are the nimblest of all other crabs; they run with surprising agility along the upright side of a rock, and even under rocks that hang horizontally over the sea; this they are often necessitated to do for escaping the assaults of rapacious birds which pursue them. These crabs, so far as I could observe, never go to land, but frequent mostly those parts of the promontories and islands of rocks in and near the sea, where, by the continual and violent agitation of the waves against the rocks, they are always wet, continually receiving the spray of the sea, which often washes them into it; but they instantly return to the rock again, not being able to live under water, and yet requiring more of that element than any of the crustaceous kinds that are not fish.'

M. Milne Edwards remarks that MM. Quoy and Gaimard brought from the Sandwich Islands a *Grapsus* which bears a strong analogy to *Grapsus pictus*, but which, it appears to him, ought to be distinguished from it, on account of the great number of little conical hairs disposed in small transversal ranks on the branchial and stomachal regions, the greater extent of the front, and some other characters; but as he had not examined more than one individual in a bad state of preservation, and as *Grapsus pictus* presents considerable individual differences, he cannot pronounce on the distinction decidedly, but notes the fact on account of its interest in regard of zoological geography. He observes that in the collection of the Paris museum he has designated this crustacean under the name of *Grapsus rudis*, and that it is probably the species figured by MM. Quoy and Gaimard under the name of the *Painted Grapsus*. (*Voyage de M. Freycinet*, pl. 76, fig. 2.)

B. Third joint of the external jaw-feet as wide as it is long, and dilated outwards towards the anterior angle.

Example, *Grapsus varius* (*Cancre Madrè?* Rondelet; *Cancer marmoratus*, Fabricius; *Grapsus varius*, Latreille). Length about eighteen lines. Colour violaceous-red, variegated with small irregular yellowish stains. *Locality*, the rocky parts of the coasts of Bretagne, Italy, &c. (very common).

Nautilograpsus. (M. Edwards.)

Differing but little from *Grapsus*. *Carapace*, instead of being wider than it is long and nearly flat, as in *Grapsus*, longer than it is large, and convex above. *Regions* not distinct. *Front* advanced, lamellar, and simply inclined. Lateral borders curved and long. Internal border of the second joint of the *jaw-feet* nearly straight, and the third joint even longer than in *Grapsus varius*, but nearly of the same form. *Feet* much shorter than in *Grapsus*. The intromissive organs of the male traverse a simple notch of the border of the sternal plastron. For the rest resembling the *Grapsi* of the second division.

Geographical Distribution.—The single species known is found in all latitudes and met with far at sea, often floating on *fucus natans*, or on large marine animals.

Example, *Nautilograpsus minutus* (*Cancellus marinus quadratus*, Sloane; *Turtle-Crab*, Browne; *Cancer minutus*, Fabricius; *Grapsus minutus*, Latreille; *Grapsus cinereus*, Say; *Grapse unie*, Lamarck,—*Gal. du Mus.*) Length from 4 to 8 lines, varying much in colour. M. Milne Edwards says that he sees no sufficient reason for distinguishing this species from *Grapsus testudinum*, Roux.

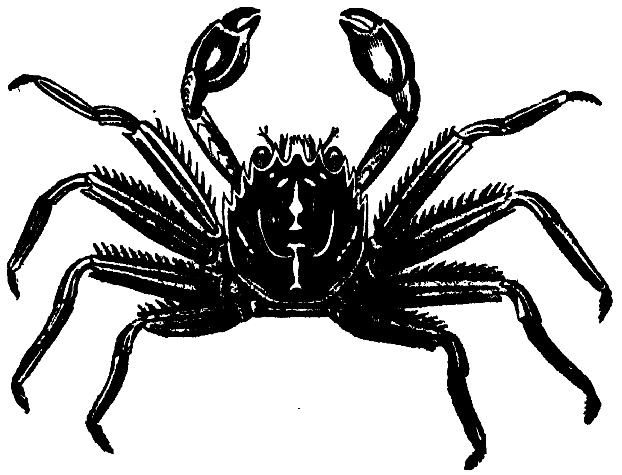
Plagusia. (Latreille.)

Resembling *Grapsus* generally, but distinguished at once by a singular disposition of the *internal antennæ* not met with in any other brachyurous decapod, according to M. Milne Edwards. These organs, instead of being bent back under the front, are each lodged in a deep notch in this part, so as always to be uncovered superiorly. *Carapace* broad and flattened, its anterior border occupying only one-half of its width, which is most extended towards the level of the last pair of feet but one. Portion of the *front* between the antennary pits triangular and curved downwards. *Eyes* short and large; *orbits* directed forwards and upwards, and separated from the antennary pits. *Internal antennæ* vertical; *external antennæ* occupying the internal angle of the orbit, and nearly of the same form as in *Grapsus*. Anterior border of the *buccal frame* very projecting, and continuous with the lower orbital border. The *external jaw-feet* close the mouth completely, and are not notched within as in *Grapsus*; they are in form generally very nearly the same as in the *Crabs* and *Portunus*; the third joint is much shorter than the preceding one, nearly square, and notched at its anterior and internal angle for the insertion of the succeeding joint. *Sternum* very wide and deeply notched backwards for the reception of the abdomen. Anterior *feet* generally moderate in the *male* and small in the female; claws ordinarily with a spoon-shaped termination; succeeding feet disposed as in *Grapsus*; sometimes the third, sometimes the fourth pair longest: they are in general ciliated on the superior border, and the tarsus is always armed with strong spines. *Abdomen* and *Branchiæ* as in *Grapsus*.

Geographical Distribution.—*Plagusia* belongs more particularly to the Indian Ocean, and is found from the Cape of Good Hope to Chili. (M. Edwards.)

A. Species having the superior border of the eight last feet armed with teeth nearly throughout its length.

Example, *Plagusia clavimana* (*Cancer planissimus*, Herbst). Length rather more than an inch: antepenultimate ring of the abdomen soldered to the preceding ring in both sexes. *Locality*, New Holland, Vanicoro, New Zealand.



Plagusia clavimana.

B. Species whose four last pair of feet are not armed above with more than a single tooth placed near the extremity of the upper border of their third joint.

Example, *Plagusia depressa* (*Cancer depressus*, Herbst; *Grapsus depressus*, Latreille; *Plagusia immaculata*, Lamarck; *Plagusia depressa*, Latreille). *Locality*, Indian Ocean, Seas of China, New Guinea, &c.

M. Milne Edwards observes that the specific name of this *Plagusia* is badly chosen, inasmuch as it is less flattened than the greater part of the species. He is also of opinion that *Plagusia depressa* of Say (*Acad. Philad.*, tom. i., p. 100) appears to be nearer to *Plagusia squamosa* than the species here mentioned, but he thinks that it ought probably to be distinguished from it.

Varuna. (M. Edwards.)

Carapace very much depressed and nearly quadrilateral, but the lateral borders arched. *Front* wide, straight, and trenchant. *Orbits* approaching to oval; a fissure on their superior border, their external angle very salient, and hardly any inferior border. *Internal antennæ* bent back a little obliquely outwards, and their pits completely separated from the orbits by the basilary joint of the external antennæ, which joins the front, and presents nothing remarkable. *Epistome* larger than it is in the greater part of the Grapsoïdians, and *external jaw-feet* nearly joining it; their internal border is nearly straight, and the third joint, very much dilated externally, carries the following joint towards the middle of its anterior border, which is very large and notched. *Anterior feet* large; and the succeeding feet, instead of terminating by a large and cylindrical or styliform tarsus, as in the other Grapsoïdians, with their last joint wide, flattened, ciliated on the edges, and lanceolate. *Abdomen* of the *male* with seven distinct joints.

Example (sole species known), *Varuna litterata* (*Cancer litteratus*, Fabricius; *Grapsus litteratus*, Bosc.). *Locality*, Indian Ocean.

Fossil Grapsoïdians?

M. Milne Edwards observes that the fossil crustacean described by M. Desmarest under the name of *Gecarcinus trispinosus* ('Crust. Foss.') appears to him to resemble *Pseudograpsus pencilliger* more than any other brachyurous crustacean. [Gecarcinus, vol. xi., p. 101.]

GRAPTO'LITHUS, (literally 'written-stone'), a name used by Linnæus chiefly to include appearances in stones resembling drawings—as of maps, ruins, vegetable forms, &c. Thus the Florentine, or ruin marble, the dendritical ramifications on many limestones, and the moss-like forms in agates, &c., were ranked as Graptolites.

Among the species included by Linnæus is one resembling algæ, from the transition strata of Gothland.

GRASS LAND may be divided into water-meadows, upland pastures, and artificial grasses. The first are treated of under Irrigation: the nature and management of the two last we shall here briefly describe. Upland pastures are portions of land on which the natural grasses grow spontaneously, varying in quantity and quality with the soil and situation. The plants which form the natural sward are not confined to the family of the gramineæ, but many other plants, chiefly with perennial roots, form part of the herbage. In the richest soils the variety is exceedingly great. When a sod is taken up, and all the plants on it are examined, the species will be found more numerous than we should have believed possible;* and in the same ground the plants will vary in different years, so as to induce one to conclude, that, like most other herbaceous plants, the grasses degenerate when they have grown for a long time on the same spot, and that a kind of rotation is established by nature. It is chiefly in those pastures where the grasses are allowed to grow till they form their seed that this is observable; for when they are closely fed, and not allowed to shoot out a seed-stem, they are less subject to degenerate and disappear. This may be a reason why experienced dairymen are so unwilling to allow their best pastures to be mown for hay. They pretend that the feed is deteriorated in the next year, and that inferior grasses are introduced which injure the quality of their butter and cheese. Close feeding is always considered as the most advantageous, both to the cattle and the proprietor.

The only way in which a pasture can be profitable is by feeding stock; and its value is in the exact proportion to the number of sheep or cattle which can be fed upon it in a season. Extensive pastures are often measured only by their capacity in this respect. Thus we speak of downs for 1000 sheep; and in Switzerland and other mountainous countries they talk of a mountain of 40, 60, or 100 cows, without any mention of extent in acres.

When a pasture is naturally rich, the only care required is to stock it judiciously, to move the cattle frequently from one spot to another (for which purpose inclosures well fenced are highly advantageous), and to eradicate certain plants which are useless or noxious, such as docks and thistles, furze, broom, briars and thorns, which, not being touched by the cattle as long as they have better food, would increase and overrun the ground, and take up a space which would be more profitably occupied by good herbage. The dung of the cattle also, when left in heaps as it is dropped, kills the grass and introduces course and less palatable plants. This must be carefully beat about and spread, or carried together in heaps to make composts with earth, to manure the poorer meadows or the arable land. All that is required in rich pastures in which cows and oxen are fed, and which are properly stocked, is to prevent the increase of the coarser and less nutritive plants. Weeding is as important in grass as in arable land; and if it is neglected the consequence will soon be observed by the inferior quality of the feed. The urine of the cattle is the manure which chiefly keeps up the fertility of grass land; and although in hot and dry weather it frequently burns up the grass where it falls, when it is diluted by showers the improved appearance of the surface shows that its effect has not been detrimental. To enrich poor meadows there is no manure so effective as diluted urine, or the drainings of stables and dung-hills.

When pastures are poor, and the herbage is of a bad quality, the cause is to be sought for in the soil. A poor arid soil is not fitted for grass, nor one which is too wet from the abundance of springs and the want of outlet for the water. These defects can only be remedied by expensive improvements. A soil which is too dry may be improved by cultivation and judicious manuring; but for this purpose it must be broken up and treated for some time as arable land: and it may be a question whether or not the expense of improving the soil will be repaid by the superior quality of the pasture when it is again laid down to grass. In general the poor light soils, if they are worth cultivation, answer better as arable land, especially where the turnip husbandry is well understood. The low wet clay soils may be converted into good pastures by draining them well; and the improvement thus produced is so great, that judicious draining in such soils is the most profitable investment of capital.

When old meadows have been neglected, or too often mown, without being recruited by manure or irrigation, they are often overrun with moss or rushes, and produce nothing but a coarse sour grass. In that case, besides draining it if required, the land must be broken up and undergo a regular course of tillage, until the whole of the old sward is destroyed, and a better collection of grasses covers its surface. If this be done judiciously, the pasture will not only be greatly improved in the quality, but also in the quantity of the grass. There is a natural prejudice against the breaking up of old grass land. This has arisen from the improper manner in which it is frequently effected. The sward when rotten is a powerful manure, and produces great crops of corn. These tempt the farmer to repeat the sowing of corn on newly broken up lands. The fertility is reduced rapidly; and when grass seeds are sown after several crops of corn, the soil has been deprived of a great portion of the humus and vegetable matter which is essential to the growth of rich grass. The proper method of treating grass land, broken up to improve it, is to take no more corn crops than will pay the expense of breaking up, carting earth, lime, or other substances upon it, to improve the soil, and to lay it down to grass again as soon as the old sward is fully destroyed.

If the soil is fit for turnips, no better crop can be sown to prepare for the grass seeds, which should be sown without a corn crop, except where the sun is powerful, and the seed is sown late in spring: but autumn is by far the best season for sowing grass seeds for permanent pasture. Turnips of an early kind may be sown in May, and fed off with sheep in August or September; and the ground being only very slightly ploughed, or rather scarified, and harrowed fine, the seeds may be sown and rolled in. The species of grasses sown must depend on the nature of the soil; but it is impossible to be too choice in the selection. That mixture of chaff and the half-ripe seeds of weeds, commonly called hay seeds, which is collected from the stable lofts, should be carefully rejected, and none but seeds ripened and collected on purpose should be sown. The Trifolium repens (white clover), the Trifolium medium (cow grass), Medicago lupinula (trefoil), Lolium perenne (rye grass), the poas and festucas, are the best kinds of grasses. A very easy way of obtaining good seed is to keep a piece of good meadow shut up from the cattle early in spring, carefully weeding out any coarse grasses, and letting the best arrive at full maturity; then mow and dry the crop, and thresh it out upon a cloth. This will give the best mixture of seeds; but some of the earliest will have been shed, and these should be collected separately, or purchased from the seedsmen. Before winter, the ground will already be covered with a fine green, if the seed has been plentiful. The quantity per acre of the mixed seeds should not be less than 30 or 40 pounds to insure a close pile the next year. If the soil is not naturally rich, liquid manure, or urine diluted with water, should be carried to the field in a water-cart, and the young grass watered with it. This will so invigorate the plants that they will strike and tiller abundantly. They should be fed off by sheep, but not too close. The tread of the sheep and their urine will tend to make the pile of grass close; and the year after this the new pasture will only be distinguished from the old by its verdure and freshness.

In some soils which are not congenial to grass the seed does not take so well as in others; and there is a great difficulty in producing a good sward. In this case recourse may be had to planting, or, as some call it, inoculating grass. This is done by taking pieces of sward from an old

* In a sod of grass taken from Selborne Common, the following grasses were found:—Plantago lanceolata, Agrostis capillaris, Avena flavescens, Dactylis glomerata, Festuca duriuscula, Poa annua, Cynosurus cristatus, Trifolium repens, Crepis tectorum, Achillea millefolium, Galium verum, Hypochæris radicata, Hieracium pilosella, Thymus serpyllum. (Curtis *On Grasses*.)

meadow, and spreading them over the surface of the land to be laid down, after it has been ploughed and prepared in the same manner as it would be to receive the seed. The turf of the old meadow is taken up with a peculiar instrument in strips two inches wide, and these strips are cut across so as to form little square pieces, which are spread over the ground, leaving about five or six inches of interval between every two pieces. The heavy roller presses them into the ground. These tufts soon spread and fill up all the intervals with a complete old sward. This is a very effectual and certain method of producing a permanent pasture. Some attention is required to prevent weeds in the intervals between the tufts at first: by going over the field with a narrow hoe all weeds may be easily kept down; and the roots and tillers of the grass soon fill up the vacant spaces.

The fertility produced by grass which is fed by cattle and sheep has given rise to the practice of converting arable land to pasture for a certain time in order to recruit its strength. The old notion was that the land had *rest*, which by a confusion of ideas was associated with the rest of the labourers and the horses. Ploughing was called working the land; and some men talked of working out the heart of the land by ploughing. That the ploughing of land does not diminish the productive power of all soils that are fit for cultivation will be readily allowed. The sea sand no doubt, where a few bents have taken root, would not be improved by being stirred; neither would very light soils under a burning sun: but in our moist climate there is seldom any danger of over-ploughing. The land, by being in grass, has much vegetable matter added to it from the fibres of the roots which die and decay, as well as from the other parts of the grass, which draw nourishment from the atmosphere and impart it to the roots. Thus in time an accumulation of humus is formed; and when the land is ploughed the rotting of the sward greatly increases it. Every species of plant thrives well in this improved soil; and the vigour of the growth is ascribed to the recruiting effects of rest, by a fancied analogy with the animal muscle, which is invigorated by occasional inaction.

But setting aside theory, it is well known that land which has been some years in grass is improved in fertility. The convertible system of husbandry takes advantage of this fact; and all its art consists in reproducing a good pasture without loss of time, after having reaped the benefit of the fertility imparted to the land during three or four years when it was in grass. Good pasture is very profitable; so are good crops: by making the one subservient to the other, the farmer who adopts the convertible system is enabled to pay higher rents, and still have a better profit than those who adhere to a simple rotation of annual crops.

When an arable field is sown with the seeds of grasses and other plants which give herbage for cattle it is called an artificial meadow, and the various plants which are raised are all called artificial grasses, although many of them have no botanical title to the name of grass, such as clover, saintfoin, lucern, and many others, which produce the best pastures and the finest hay.

In laying down a field to grass for a very few years the mode of proceeding is somewhat different from that which is recommended for producing a permanent pasture. Clover in this case is always a principal plant, both the red and the white; these with annual or perennial rye grass are sown with a crop of corn in spring, and begin to show themselves before harvest. The grasses are often mown the first year after they are sown, on account of the abundance and value of the red clover, but the best farmers recommend the depasturing them with sheep, to strengthen the roots and increase the bulk. Various circumstances, such as a greater demand for clover hay, or for fat cattle, may make mowing or feeding most profitable; but when there is not a decided advantage in making hay, feeding should always be preferred. At all events the great object of the farmer should be to have his land in good heart and tilth, and free from weeds, when the grass is sown. If his grass is good he is certain of good crops after it with little trouble or manure.

The seeds usually sown on an acre, when the land is laid down to grass, are as follows:—Red clover 12 lb., white 6 lb., trefoil 4 lb., rib grass 2 lb., and 2 pecks of Pacey's rye grass. Sometimes cockfoot grass (Dactylis glomerata) and cow grass (Trifolium medium) are added. This is for a field intended to remain four or five years in grass.'

The introduction of artificial meadows, in districts where the soil seemed not well adapted for pasture, has greatly increased the number of cattle and sheep reared and fattened, and has caused greater attention to be paid to the means of improving the breeds of both. Thus a double advantage has arisen: the public is benefited by an increased supply, and the farmer is rewarded by an additional source of profit.

In the neighbourhood of large towns there are many meadows, which, without being irrigated, are mown every year, and only fed between hay harvest and the next spring. These require frequent manuring to keep them in heart, and with this assistance they produce great crops of hay every year. The management of this grass land is well understood in Middlesex. Sometimes the meadows are manured with stable dung which has been laid in a heap for some time, and been turned over to rot it equally. This is put on soon after the hay is cut, and the rains of July wash the dung into the ground; but if a very dry and hot summer follows, little benefit is produced by the dung, which is dried up, and most of the juices evaporated. A better method is to make a compost with earth and dung, and, where it can be easily obtained, with chalk, or the old mortar of buildings pulled down. The best earth is that which contains most vegetable matter; and as many of these meadows are on a stiff clay soil, which requires to be kept dry by open drains and water furrows, the soil dug out of these and carted to a corner of the meadow makes an excellent foundation for the compost. It is sometimes useful to plough furrows at intervals to take off the superfluous surface-water in winter; the earth thus raised by the plough is excellent to mix in the compost; having been turned over with dung, sweepings of streets, or any other manure, so as to form a uniform mass, it is spread over the land in winter; and in spring a bush-harrow is drawn over the meadow, and it is rolled with a heavy roller. All this compost is soon washed into the ground, and invigorates the roots of the grass. It is better to put on a slight coating of this compost every year than to give a greater portion of manure every three or four years, as is the practice of some farmers. When grass land is let to a tenant, it requires some attention, and particular conditions in the lease, to prevent the meadows being deteriorated by continual mowing without sufficient manuring, which might be the case near the expiration of the lease. It is very common to insist, by a clause, on a cart-load of stable dung being bought for every load of hay which is made and not consumed on the premises. Sometimes the tenant is bound to feed the land in alternate years; but if horses or heavy cattle should be taken in, especially in spring and autumn, they may do more harm by their treading, when the ground is soft, than would have been done by taking off a crop of hay. When the proprietor of meadows resides near them, he often finds it most profitable to keep them in hand, and sell the crop when it is fit to be mown. In that case he must be careful to manure them sufficiently, or his profits will soon diminish rapidly. The grazing of cattle has generally been a more profitable occupation than simply tilling the land. The capital required is considerable, but the current expenses are not great. The grazier is not subject to such total failures as the farmer of arable land is in his crops. With a little experience and prudence, he can always reckon on a certain return. An acre of good grazing land, worth 40*s*. rent, is supposed to produce 200 lb. of meat in the year. If this is worth 6*d*. a pound, the gross produce is 5*l*. per acre. The expenses will not exceed 10*s*. per acre, so that here is a net profit of 2*l*. 10*s*. per acre with little or no risk; few arable farms will average this net profit. By uniting the raising of corn and the grazing of cattle and sheep, the greatest profit is probably obtained, and this is the great argument in favour of the convertible system of husbandry.

GRASSE, a town in France, in the department of Var, is situated on the slope of a hill which commands a plain abounding with odoriferous plants, whose flowers afford nourishment to large swarms of bees, and the extracts from them furnish the inhabitants with the means of manufacturing the liqueurs, scented soaps, and essences, in which their chief trade consists. The streets of the town are narrow, steep, and winding; but the houses are tolerably well built: the place is insupportably hot in summer. There is a public walk, and one handsome fountain. The population in 1831 was 7552 for the town, or 12,716 for the

whole commune. Beside the articles of perfumery noticed above, they manufacture leather, silk, and linen yarn. There are three yearly fairs. The neighbourhood produces olives (from which excellent oil is expressed and exported), oranges, lemons, and figs. Marble and jasper are quarried in the neighbourhood.

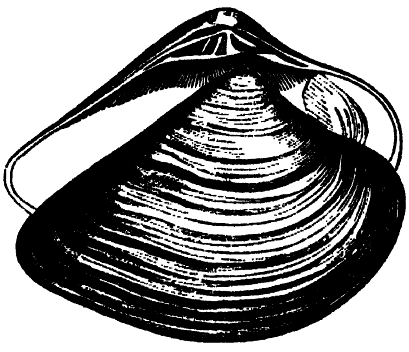
Grasse is the capital of an arrondissement: it possesses a high-school, a small seminary for the priesthood, a small public library, an agricultural society, three hospitals, an exchange, and some public offices. Before the Revolution it was the seat of a bishopric, transferred here from Antibes in the year 1250.

The arrondissement of Grasse contains 8 cantons and 63 communes: it had in 1831 a population of 65,488.

GRATELU'PIA, a genus of conchifers established by M. Charles Desmoulins for a fossil bivalve which had been confounded by M. de Basterot with the genus *Donax*, under the name of *Donax irregularis*. But one species, *Gratelupia donaciformis*, was known (from Bordeaux, Miocene formation of Lyell), till Mr. Lea discovered a second in the Claiborne tertiary (Eocene of Lyell), which he has named *Gratelupia Moulinsii*, after the founder of the genus. Diam. 1 inch, Length 1·4, Breadth 1·9.

Generic Character.—Animal unknown. *Shell* subtrigonal, equivalve, regular, nearly equilateral, a little attenuated at its posterior part, and presenting at the postero-inferior border a slight sinuosity. *Umbones* very small, projecting but little, and hardly inclined forwards. *Hinge* consisting of three cardinal divergent *teeth* in each valve, and of from three to six cardini-serial teeth converging towards their summits, lamellar, with their edges finely dentilated, and situated a little behind the summit, under the ligament; a single lateral anterior tooth under the lunule in the left valve, corresponding with a pit similarly situated in the right valve; external *ligament* long, convex, overpassing the serial teeth. *Muscular impressions* nearly equal, oval, united by a pallial impression largely and very deeply excavated backwards.

The genus was named by M. C. Desmoulins after Dr. Grateloup.



Gratelupia Moulinsii. (Lea.)

GRATIA'NUS, AUGUSTUS, eldest son of Valentinian I., succeeded after his father's death, A.D. 375, to a share of the Western Empire, having for his lot Gaul, Spain, and Britain; his brother Valentinian II., then an infant five years old, had Italy, Illyricum, and Africa, under the guardianship however of Gratianus, who was therefore in reality ruler of all the West. His uncle Valens had the Empire of the East. Gratianus began his reign by punishing severely various præfects and other officers who had committed acts of oppression and cruelty during his father's reign. At the same time, through some insidious charges, Count Theodosius, father of Theodosius the Great, and one of the most illustrious men of his age, was beheaded at Carthage. In the year 378 Valens perished in the battle of Adrianople against the Goths, and Gratianus, who was hastening to his assistance, was hardly able to save Constantinople from falling into the hands of the enemy. In consequence of the death of his uncle, Gratianus, finding himself ruler of the whole Roman empire during the minority of his brother Valentinian, called to him young Theodosius, who had distinguished himself in the Roman armies, but had retired into Spain after his father's death. Gratianus sent him against the Sarmatians, who had crossed the Danube to join the Goths. Theodosius defeated them completely, and drove the remainder beyond that river. Gratianus then appointed him his colleague (in January, 379), a choice wise and disinterested in the former, equally creditable to both, and fortunate for the empire, and gave him the provinces of the East. Gratianus returned to Italy, and resided some time at Milan, where he became intimate with Bishop Ambrose. He was obliged however soon after to hasten to Illyricum to the assistance of Theodosius, and he repelled the Goths, who were threatening Thrace. From thence he was obliged to hasten to the banks of the Rhine to fight the Alemanni and other barbarians. Having returned to Milan in the year 381, he had to defend the frontiers of Italy from other tribes who were advancing on the side of Rhætia, and he ordered fresh levies of men and horses for the purpose. Gratianus enacted several wise laws: by one of them he checked mendicity, which had spread to an alarming extent in Italy; and he ordered all beggars to be arrested, and, if slaves by condition, to be given up as such to those who denounced them; if freemen, to be employed in cultivating the land. He also showed himself disposed to tolerance towards the various sects which divided Christianity; but he displayed a stern determination against the remains of the Heathen worship. At Rome he overthrew the altar of Victory, which continued to exist; he confiscated the property attached to it, as well as all the property belonging to the other priests and the Vestals. He also refused to assume the title and the insignia of Pontifex Maximus, a dignity till then considered as annexed to that of emperor. These measures gave a final blow to the old worship of the empire; and although the senators, who for the most part were still attached to it, sent him a deputation, at the head of which was Symmachus, they could not obtain any mitigation of his decrees.

Under the consulship of Merabaudus and Saturninus, A.D. 383, a certain Maximus revolted in Britain, and was proclaimed emperor by the soldiers, to whom he promised to re-establish the temples and the old religion of the empire. He invaded Gaul, where he found numerous partisans. Gratianus, who was then, according to some, on the Rhine, advanced to meet him, but was forsaken by most of his troops, and obliged to hasten towards Italy. Orosius and others however state that the emperor received the news of the revolt while in Italy, and that he hurried across the Alps with a small retinue as far as Lyon. All however agree in saying that he was seized at Lyon and put to death by the partisans of Maximus. St. Ambrose, who ventured from Milan to the camp of Maximus to beg the body of his imperial friend, was refused; but some time afterwards the remains of Gratianus were transferred to Milan, where they were interred. He was little more than 24 years of age, and had reigned about eight years. The historians agree in praising him for his justice and kindness, and his zeal for the public good; and Ammianus Marcellinus, who is not liable to the charge of partiality towards the Christians, adds, that had he lived longer, he would have rivalled the best emperors of antient Rome.

Coin of Gratianus.

British Museum. Actual Size. Gold. Weight, 67¼ grains.

GRATIA'NUS, a Benedictine monk of the twelfth century, a native of Tuscany, according to some, and resident at Bologna. He is chiefly known for his 'Collection of the Canons, or Decretals, of the Church,' which occupied him during twenty-four years, and which he published at Rome about the middle of the twelfth century. The collection, which has become known by the name of 'Decretum Gratiani,' was first printed at Mainz, in folio, 1472, and forms part of the 'Corpus Juris Canonici.' [CANON LAW.] Gratianus improved on the collectors of Decretals who had preceded him, especially Isidorus Mercator, who had heaped up indiscriminately and without order a number of decisions and canons, which were often discordant. Gratianus ranged them in order, and distributed them under distinct heads, endeavouring to explain the obscurities and reconcile the contradictions which appeared in some of them. But he retained at the same time, through want of authentic authorities and of enlightened criticism, many apocryphal canons, and many erroneous textual read-

ings: he appears indeed to have felt his own deficiencies, for he honestly cautions his readers not to place implicit faith in his writings, but to scan them by the light of reason and by the test of moral evidence. (*Decret. Distinctio*, ix., ch. 3-5.)

As a proof of his honesty, and that, whatever may have been the effect of his authority, he had no intention to flatter the pretensions of the Roman see, one has only to read his 'Distinctio,' lxiii., ch. 22, 23, and 25, in which he says that the election of the pope is subordinate to the will of the emperor, as well as that of the bishops is to the choice of the various sovereigns; while in ch. 34 he even asserts that the clergy and the people ought to participate in the election of their respective bishops. And yet in another place, 'Distinctio,' x., ch. 1, &c., he asserts as a fundamental axiom that the imperial laws ought to yield to the ecclesiastical canons, without distinguishing between the canons which concern matters of dogma and those which relate merely to discipline or jurisdiction. The Abbé Fleury, in his 'Troisième Discours sur l'Histoire Ecclésiastique,' says that 'Gratianus, besides so consolidating the authority of the false decretals, that for three centuries after no other canons were referred to but those of his collection, went even farther in extending the authority of the pope, by maintaining that he was not himself subject to the canons; an arbitrary assertion destitute of evidence, but which contributed to establish in the Latin, or Western, church a confused notion that the authority of the pope was without bounds. Gratianus also maintained, upon apocryphal or mutilated authority, that clergymen are not subject to secular jurisdiction. This principle is illustrated in a celebrated answer of Innocent III. to the Eastern emperor, in which that pope contends that the temporal sovereign has the jurisdiction of the sword over those who bear a sword, that is to say, over laymen only, as no one can be the judge of the servants of another.'

The grosser errors and the apocrypha of the 'Decretum' were corrected and expurgated in an improved edition executed by order of Gregory XIII., 1582; but still many assertions favourable to the absolute supremacy as well as to the temporal authority of the popes were allowed to remain in it, as being sanctioned by ages, though contrary to the antient discipline of the church. These are what are styled in France and other countries north of the Alps the ultramontane doctrines of the Roman Curia. Antonius Augustinus has written a treatise, 'De Emendatione Gratiani,' which forms a useful supplement to the 'Decretum.'

GRATTAN, HENRY, was born in Dublin in the year 1750. His father, a barrister and a Protestant, was recorder of Dublin and also its representative in the Irish parliament. Young Grattan entered, at the usual age, as a fellow-commoner, at Trinity College, Dublin; and having here distinguished himself considerably, he proceeded to London, after taking his degree, for the purpose of keeping terms at the Middle Temple, and of studying law. He was called to the Irish bar in 1772. In 1775 he was returned to the Irish parliament, under Lord Charlemont's auspices, as representative of the borough of Charlemont.

In parliament he at once joined the ranks of opposition. Exerting his nervous eloquence in the cause of his country's independence, he in a very short time gained to himself the admiration and love, while he contributed not a little to swell the enthusiasm, of the Irish nation. At this period Ireland had to complain, not only of the dependent state of her legislature and courts of justice, but also of grievous commercial restrictions: and one of the first great fruits of Grattan's zeal and eloquence was the partial throwing open of Irish commerce. Subsequently, in 1780, he obtained from the Irish parliament the memorable resolution 'that the King's most excellent Majesty and the Lords and Commons of Ireland are the only power competent to make laws to bind Ireland.' The peroration of the speech in which he moved this resolution is a noble specimen of his eloquence. 'I will not be answered by a public lie in the shape of an amendment; neither, speaking for the subjects' freedom, am I to hear of faction. I wish for nothing but to breathe, in this our land, in common with my fellow-subjects, the air of liberty. I have no ambition, unless it be the ambition to break your chain, and contemplate your glory. I never will be satisfied so long as the meanest cottager in Ireland has a link of the British chain clanking to his rags. He may be naked; he shall not be in iron. And I do see the time is at hand, the spirit is gone forth, the declaration is planted: and though great men should apostatize, yet the cause will live; and though the public speaker should die, yet the immortal fire shall outlast the organ which conveyed it, and the breath of liberty, like the word of the holy man, will not die with the prophet, but survive him.'

Such was the pitch of popularity to which Grattan had now attained, that it was proposed in the Irish parliament to vote him the sum of 100,000*l.*, 'as a testimony of the national gratitude for great national services.' The vote was afterwards reduced in committee, at the express instance of Grattan's own friends, to 50,000*l.*; and this sum Grattan received. In consequence of the declaration of rights of the Irish parliament, a negotiation was set on foot for the repeal of the act (6th of George I.) by which the British legislature declared its right to bind Ireland by British statutes. When the repeal of this act was brought forward in England, Mr. Flood contended in the Irish parliament that the simple repeal of a declaratory act, like the 6th of George I., would not involve a renunciation of the right; and after moving some other resolutions which implied dissatisfaction with a simple repeal of the act, and which were successively negatived without a division, he at last moved for leave to bring in a bill for declaring the exclusive right of the Irish parliament to make laws for Ireland. Grattan differed from the view taken by Mr. Flood, and contended that the simple repeal of the act was a sufficient security for the independence of Ireland. Mr. Flood's bill was thrown out by a large majority. But though the opinion of the Irish House of Commons was with Grattan, the sympathies of the Irish nation were with Mr. Flood. A belief gained ground, and was much encouraged by Mr. Flood's acrimonious attacks, that having received his reward, Grattan had ceased to be a patriot; and he now for a time undeservedly lost much of his well-earned popularity.

His opposition however, in 1785, to the propositions regarding the trade between Great Britain and Ireland, moved by Mr. Orde in the Irish parliament, and ever since well known as Orde's Propositions, restored him to his lost place in the affections of his countrymen. One of these propositions was to the effect that the Irish parliament should from time to time adopt and enact all such acts of the British parliament as should relate to the regulation or management of her commerce. The Irish parliament would thus have been placed so far in a state of complete dependence; but owing principally to Grattan's efforts in opposition, the measure was relinquished. And he went on to secure a continuance of his now regained popularity by the introduction of a measure for getting rid of tithes, which was however rejected. Occupying moreover the leading place in the Whig Club which then existed in Dublin, Grattan succeeded in obtaining a public declaration from its members that they would never accept office under any administration which would not concede certain measures tending to increase purity of election and ministerial responsibility. In 1790 Grattan was returned to parliament for Dublin.

In the parliament which now met, the question of Catholic Emancipation being raised, Grattan appeared of course as the friend of religious liberty. He thereby offended his new constituents. There is no doubt that the course which he took upon this question would have prevented his reelection, had he desired it; but finding himself unable to stem that movement which, originating with the recal of Lord Fitzwilliam, terminated in the rebellion of 1798, he voluntarily retired from parliament. He was afterwards returned for Wicklow, for the express purpose of opposing the Union. The Union was carried, and in 1805 he entered the Imperial parliament as member for the borough of Malton. The next year he was returned for Dublin. Preserving in his new position the reputation which he had before acquired for eloquence, he also adhered inflexibly to those principles of toleration and popular government of which in Ireland he had been the champion. He lost no opportunity of advocating the Catholic claims. He may be said indeed to have died in the cause of Catholic Emancipation. He had undertaken to present a petition from the Irish Catholics, and to support it in parliament, notwithstanding the remonstrances of his friends that the exertion would be incompatible with his declining health. 'I should be happy,' he replied to those remonstrances, 'to die in the discharge of my duty.' He had scarcely arrived in London

with the petition, when his debility greatly increased. He died on the 14th of May, 1820, at the age of seventy. His remains were interred in Westminster Abbey; and on the occasion of moving for a new writ for the city of Dublin, Sir James Mackintosh pronounced an eloquent eulogium on his life and character.

There is no need to dwell on the public character of Grattan, inasmuch as, his honesty and consistency never having been impeached, it requires no defence. In private life he was irreproachable. 'He is one of the few private men,' said Sir James Mackintosh, 'whose private virtues were followed by public fame; he is one of the few public men whose private virtues are to be cited as examples to those who would follow in his public steps. He was as eminent in his observance of all the duties of private life as he was heroic in the discharge of his public ones.'

Grattan's speeches were collected and published by his son, in four volumes, 8vo., in 1821. There is also a volume of his miscellaneous works.

GRÄTZ, a circle of Styria, bounded on the north-east by Lower Austria, and on the east by Hungary, has an area of about 2109 square miles, and contains 6 towns, 30 market-villages, and 981 villages and hamlets, and a population of about 320,000. It is rather hilly than mountainous; the latter being the character of the borders next Lower Austria only. The extensive, picturesque, and richly cultivated valley of the Mur is within the limits of Grätz. Much corn and flax are raised, great numbers of horned cattle are reared, and some wine is made in the southern districts. The forests are considerable. There are copper, lead, and iron mines, marble quarries, and coal-mines. Iron, copper, and steel ware are manufactured.

GRÄTZ (in Sclavonian *Niemetzki-Gradez*, *i. e.* the Mountain-burg or fastness of Niemetzki), the chief place in the circle and the capital of Styria, is beautifully situated on the eastern and western banks of the Mur, about 1040 feet above the level of the sea: in 47° 4′ N. lat. and 15° 26′ E. long. The fortifications are of no great strength. It consists of the Inner Town, or town itself, which lies between the eastern bank of the Mur and the Castle-hill (Schlossberg), and four suburbs, namely, the Murstadt, on the western bank of the Mur, connected with the town by two bridges, and the Jakomini, Müntzgraben, and Leonhardt suburbs, on the eastern bank. Including the village of Geidorf, which is reckoned as part of Grätz, the town contains about 2650 houses and 40,500 inhabitants; in 1819 it had 29,756 inhabitants and 2621 houses. Its whole circuit is about seven miles. The Inner Town contains only 16 streets and 13 lanes, and about 430 houses; and its glacis is planted with avenues of chestnut trees, upon which six gates open towards the river and suburbs. It is in the old style of building; the streets are narrow and irregular. It contains an open triangular space, the Place of the Corps de Garde, and the Carmelites' square; St. Agidi's, the cathedral, a Gothic structure built by the Emperor Frederic IV. in the middle of the fifteenth century, all the altars in which are finely sculptured in marble; and near it, St. Catherine's chapel, the handsomest specimen of architecture in the town, built as a mausoleum by Ferdinand II., who lies interred here with his consort, mother, and eldest son; the Imperial Burg, with its tower, opposite the cathedral, where the princes of Styria formerly resided, and in which there are a number of Roman antiquities; the Landhaus, where the nobility held their sittings, which contains an antient armoury, many archives, &c.; the town-hall, built in 1806 and 1807; the university building, containing a library of upwards of 100,000 volumes, a museum of instruments applicable to experimental philosophy, &c.; an arsenal, a theatre, several palaces of the Styrian nobility, &c. Between two of the gates on the east side of the Inner Town, the Castle-hill, a mass of limestone, which rises 300 feet above the town, has the ruins of the castle on its summit, and is laid out in plantations and gardens.

The Murstadt is the finest and most extensive of the suburbs of Grätz, being embellished with several handsome buildings and gardens. The squares of the Mur and Gries, the street of Mariahilf, in which is a large Minorite monastery, St. Mary's church which is the resort of pilgrims, the church and infirmary of the Brothers of Mercy, the nunnery, church, and infirmary of the Sisters of St. Elizabeth, and a mount with the holy cross, &c., called St. Calvary's, are the principal objects in this quarter. The Jakomini suburb has handsome and mostly regular streets, an equestrian riding-house, &c.; and the Leonhardt suburb, to the north and north-east of the Castle-hill, occupies a large space of ground at the foot of several hills, and is embellished with agreeable villas and gardens, as well as Count Attem's park, called Rosenhain.

Grätz contains altogether 22 churches and chapels, five monasteries, and two nunneries, an Ursuline seminary for females, an institution called the Joanneum, founded by the Archduke John in 1811, and comprising a cabinet of minerals, museum of botany, a good library, collections in geology, experimental philosophy, and numismatics; a botanical garden, with three conservatories; lunatic, orphan, and foundling asylums; an hospital, and a lying-in institution, &c.

The university was founded by Charles, duke of Styria, in the year 1558, and entrusted to the management of the Jesuits. It was closed by the Emperor Joseph in 1785, and re-opened by the late Emperor Francis in 1827. The number of students is between 300 and 350.

Grätz is the seat of administration for the duchy of Styria, and the residence of the bishop of Sekau. It has flourishing manufactures of steel and ironware, cottons, printed cottons and linens, woollens and woollen stuffs, silks, ribbons, fans, paper, saltpetre, hats, potters' ware, &c. It carries on much trade, particularly in iron and ironware. The environs are diversified and picturesque.

GRAUBÜ′NDTEN (GRISONS in French), a canton of Switzerland, is bounded on the north by the canton of St. Gall, on the east by the Tyrol and Vorarlberg, on the south by the Lombardo-Venetian kingdom, and on the west by the cantons of Ticino, Uri, and Glarus. It is surrounded on every side by lofty mountains, except on one point on the north, where the Rhine issues out of it through a narrow valley, along which runs the carriage-road from Coire to St. Gall and Zürich. A large offset of the Lepontian Alps detaches itself from the group of the St. Gothard, and, running in a north-eastern direction, marks the western boundary of the canton: dividing the waters of the Rhine from those of the Reuss and the Linth, it forms many high summits, covered with perpetual snow, such as the Badus and the Crispalt on the frontiers of Uri, the Dödiberg and Piz Rosein on the borders of Glarus, and the Scheibe on those of St. Gall. [GALL, ST.; GLARUS.] Another lofty range, which, under the name of the Rhætian Alps, forms part of the great central chain, runs east from the St. Gothard, dividing the waters which flow northwards into the Rhine from those which flow southwards into the Ticino; the high summits called Piz Val Rhein (above 10,800 feet), Moschelhorn, and Adula, are in this range, over which pass the two lately constructed roads of the Bernhardin and the Splugen, leading from the Grisons into Italy. East of the Splugen, at the mountain called Maloya, on the east slope of which are the sources of the Inn, the chain divides into two; one, continuing along the southern boundary of the Grisons, divides the waters that flow into the Adda from those of the Inn; and the other, running north-east, under the name of Julian Alps, Albula, &c., bounds the valley of the Inn to the north, and divides the waters of that river from those of the Rhine. [ENGADIN.]

The inclination of the surface of the canton is therefore threefold: the largest part slopes towards the north along the course of the Rhine; another part, namely, the Engadin, slopes towards the east along the course of the Inn; and lastly, there are several valleys belonging to the Grisons situated on the south or Italian side of the great central chain, and the waters of which run into the Adda and the Ticino, both affluents of the Po. No less than 241 glaciers are reckoned within the limits of the Grisons country, 150 of which send their water to the Rhine, 66 to the Danube, by means of the Inn, and 25 to the Po, by the Adda and the Ticino. (Lereschc, *Dictionnaire Géographique de la Suisse.*) The area of the canton is reckoned at 3080 square miles, its greatest length being about 80 miles from east to west, and its greatest breadth about 55 from north to south. The surface is cut into numerous valleys, about 60 in number, between large and small: the principal ones are: 1. The valley of the Vorder Rhein, or principal branch of that river, which rises at the foot of the Badus, and runs to the north-east to Coire, a distance of about 50 miles. 2. The valley of the Hinter Rhein, which rises to the east of the other at the foot of the Piz Val Rhein, and running first north-east, and then north, for

about 40 miles, joins the Vorder Rhein near Reichenau. The Splugen road runs along this valley. 3. The valley of Davos, or of the Albula, which is another affluent of the Rhine, which issues out of a small lake called Gross See, near the centre of the canton, and flows first south-west and then north-west, and after a course of about 40 miles joins the Hinter Rhein near Tusis. 4. The Prättigau, or valley of the Lanquart, a stream that rises at the foot of the Piz Linnard, in the chain which bounds Engadin to the north, flows north-west for about 30 miles, and enters the Rhine near Mayenfeld. 5. The valley of the Inn, or Engadin. [ENGADIN.] 6. The Munster Thal, a small valley east of Engadin, the waters of which flow into the Etsch, or Adige. 7. The Val Poschiavo, south of Mount Bernina, the waters of which run into the Adda. 8. The Val Bregaglia, south of the Maloya and Septimer, through which flows the river Maira, which, after passing by Chiavenna, enters the lake of Como at its northern extremity. 9. Val Misocco, a considerable valley south of Mount Bernhardin, through which flows the Moesa, an affluent of the Ticino. 10. Val Calanca, west of Val Misocco, and the waters of which run into the Moesa. All these principal valleys give access to many smaller transverse valleys, some of them between 5000 and 6000 feet above the sea. Kasthofer, in his 'Voyage dans les petits Cantons, et dans les Alpes Rhetiennes,' gives a detailed account of the rural economy of these secluded Alpine districts.

The population of the canton of the Grisons is reckoned by the latest authorities at about 96,000, of whom one-third speak German, and the rest speak the Romansch and Ladin dialects, except those of the valleys south of the Alps, who speak a Lombard dialect of the Italian. One-third of the whole are Catholics, and the rest Protestants of the Helvetic communion. The productions of the soil are extremely varied, according to the elevation of the ground and the aspect of the respective valleys. Some enjoy almost an Italian climate, and the vine, wheat, maize, and the fig and the almond thrive in them, whilst others produce with difficulty scanty crops of barley and rye. Hemp and flax are largely cultivated, as well as potatoes, turnips, carrots, and other roots. A considerable part of the canton is occupied by pastures and forests. There are about 100,000 head of large cattle, as many sheep, 70,000 goats, and a large quantity of pigs, but few horses. Cattle and cheese are exported to the Italian markets. The mountains are inhabited by a vast quantity of game, besides bears, wolves, lynxes, and wild cats. Trout and salmon are found in the rivers.

The canton of the Grisons is a confederation of little republics, a Switzerland in miniature. It is divided into twenty-five jurisdictions; each jurisdiction appoints its own magistrates, and makes its own laws and local regulations, by the consent of three-fourths of its citizens, that is to say, of all men above seventeen years of age, and appoints two or more deputies to the Great Council, which is the legislative body for the whole, and which again sends deputies to the annual Swiss diet to represent the canton. But the laws enacted by the Great Council are subject to the approbation of the various jurisdictions. The Little Council of three members is entrusted with the execution of the laws, and with the measures for general security. There is an upper court for the whole canton, which hears the appeals from the local courts upon matters of a certain importance. The militia of the canton, consisting of all the men able to bear arms, amounts to about 20,000 men.

The principal town of the canton is Coire (*Chur* in German), known by the name of Curia Rhætorum in the third and fourth centuries of our æra. It is a double town, consisting of the upper city surrounded by walls, which is the residence of the bishop and canons, and has a seminary and one or two convents, and about 250 inhabitants, and the lower town, which has about 350 houses and 4500 inhabitants, almost all Protestants, some fine public and private buildings, several schools, a library, and a cabinet of natural history. The situation of Coire, on the high road from Eastern Switzerland into Italy, renders its transit commerce very active, and several thriving commercial houses are found in it. The neighbourhood of Coire, in a fertile valley watered by the Plessur, about a mile from the right bank of the Rhine, and at the entrance of the highlands of the Grisons, is extremely romantic. Angelica Kauffmann was born at Coire in 1741. The canton has no other town of any importance.

The origin of the confederacy of the Grisons dates from the beginning of the fifteenth century, when the chief inhabitants of various communes in the valleys of the Upper Rhine, weary of the cruelties and oppressions of their feudal lords, assembled in a forest near the village of Trons, and there entered into a solemn compact to defend each other's property and persons, and to oblige their lords to respect the same. The abbot of Disentis willingly agreed to the compact; the counts of Werdenberg, Sax, and the baron of Rhæzuns followed his example, and in the month of May, 1424, they all repaired to the village of Trons, and there under a large maple-tree swore, in the name of the Holy Trinity, to observe the conditions of the league, which was called the Grey League, 'Graubund' from their being dressed in grey smock-frocks. The maple-tree of Trons still existed at the end of the last century, when it was felled during the French invasion. The valleys of Lower Rhætia, near Coire, also formed themselves into another league with the consent of the bishop of Coire, and this league was called Caddea, 'Casa Dei,' 'the House of God,' because those communes were mostly subject to the episcopal see. A third league was formed in 1436, after the extinction of the house of Toggenburg, among the communes of Eastern Rhætia in the valleys of the Albula and the Lanquart, and this was called the League of the Ten Jurisdictions, of which Davos was the chief place. The three leagues entered into a federal compact, and also formed an alliance with the Swiss cantons. They bravely defended their liberties against the Emperor Maximilian I., and afterwards, in the seventeenth century, against Ferdinand II. with the assistance of Louis XIII. of France. [VALTELINA.] When, in 1798, the French armies invaded Switzerland, and overturned its antient confederation, the Grisons kept aloof, and, being threatened by the French with invasion, they rose in a mass, and called in the Austrians from the Tyrol to their assistance. In 1799 their country was devastated by the French, who drove away the Austrians, and were themselves driven away again by the Russians under Suwarrow. At length, by the Act of Mediation, under Bonaparte, in 1803, the Grisons became a canton of the new Helvetic Confederation, which they have continued to be ever since. An interesting description of the Grisons country is given by Dandolo, *Lettere sul Cantone dei Grigioni*, Milan, 1829.

GRAUDENZ. [MARIENWERDER.]

GRAUN, CARL HEINRICH, a German composer of great celebrity during part of the last century, and *kapellmeister*, or director of music, to Frederick II. of Prussia, was born in Saxony in 1701. As a boy he was entered at the school of La Sainte Croix, at Dresden, where the beauty of his soprano voice soon procured him the situation of state singer. This voice afterwards changed into a high tenor of no great power, but of excellent quality. He studied composition under Schmidt, kapellmeister at Dresden, and leaving the school in 1720 he commenced composing for the church. In 1725 he succeeded Hasse as principal tenor in the opera at Brunswick, but not quite approving the airs allotted to him, he wrote one for himself, which so much pleased the court that he was immediately appointed composer to the opera. Subsequently he entered into the service of the prince royal of Prussia (afterwards Frederick the Great), for whom he composed and sang cantatas, &c. These were very numerous, and so satisfactory to the royal dilettante, that Graun's salary was augmented from a small pittance to two thousand crowns per annum. He died in 1759, in the service of Frederick, who was so much attached to him that he wept when the death of his favourite was announced. This event, Dr. Burney pleasantly remarks,

'Drew iron tears down Pluto's cheeks.'

Graun was a most voluminous composer, and many of his works perhaps deserved at the time the encomiums lavished on them; but of these few are now known, even in Germany. His operas, which are numerous, are quite forgotten. His short oratorio, *Der Tod Jesu* (*The Death of Christ*), possesses very considerable merit; but his name will be transmitted to posterity by his *Te Deum*, a work of invention, beauty, and grandeur.

GRAUWACKE (or Greywacke, as it is often written in English works on geology), a German term applied to some of the antient stratified rocks, which has been with some unwillingness admitted by English geologists, either in the

original sense, signifying a particular kind of rock, or as typifying a group or series of strata in which such rocks form a conspicuous portion.

In the former sense grauwacke rocks may be considered as having almost the same relation to clay slates that argillaceous sandstones and conglomerates bear to common clays; for argillaceous slate, by including rolled fragments or minute grains of quartz-sand, with or without mica, becomes the grauwacke and grauwacke slate of Werner and his followers. When the sand or gravel predominates so as nearly to exclude the argillaceous cement, the distinction between grauwacke and sandstone is almost imaginary, just as, on the other hand, indurated shale and soft clay slate are not always certainly distinguishable. In the pass of Lennie, above Callender, in the Lammermuir Hills, in the primary series of rocks near Cavan in Ireland, and in Snowdon, the student may study examples of the genuine grauwacke of the German writers; while fine-grained sandy rocks, corresponding to the title of grauwacke slate, are common in Westmoreland, Cumberland, Wales, the Isle of Man, the Lammermuir Hills, &c.

Viewed geologically, the grauwacke rocks lie in the midst of the primary argillaceous strata, and constitute a part of the 'transition series' of the Continental geologists. The 'grauwacke group' of Mr. De la Beche includes the 'Silurian rocks' of Mr. Murchison, and a portion of the older strata designated as 'Cambrian rocks' by Professor Sedgwick. [GEOLOGY, *Table*.] It is uncertain whether the term grauwacke will in future be used merely to characterize rocks of a certain kind lying in the Cambrian or other series of argillaceous schists, or be allowed collectively to represent a geological group of strata.

Mr. Conybeare (*Reports of the British Association*) is desirous of substituting for this somewhat rude term the more learned name of clasmoschist (κλάσμα, a fragment). M. Brongniart includes many varieties of grauwacke and grauwacke slate under the term psammite (ψάμμος, sand). [GEOLOGY; ROCKS; STRATIFICATION.]

GRAVE. [ACCENT.]

GRAVE. [BRABANT, NORTH.]

GRAVEL. The small fragments of rocks which have been drifted by any forces of water over the surface of the earth are usually designated by this general term, which is happily free from any hypothetical meaning. Many parts of the surface of the earth are so covered; from the geographical phenomena, mode of accumulation, and other circumstances, the mode of action of the water may be often completely determined. It is certain that much of the undulated surface of the land has been traversed by powerful currents of water in directions different from those of the fresh-water streams now running; that in other cases the sea has acted on the land at greater heights and under different circumstances from what we now behold; and as a great part of the evidence for this is to be collected from the study of gravel deposits, we see how important is a right knowledge of the facts concerning these in repressing vain speculation and directing sound inferences. Whether the gravel observed at any spot was transported along the natural drainage hollows of the surface may be often certainly known by inspection of the nature of the fragments and the examination of the physical geography of the country in which they occur. Whether the waters descending these valleys performed the effects while flowing at higher levels, under the influence of dams, lakes, or other peculiarities, may also often be determined by suitable examination.

It will often be thus found that the gravel was not transported down the existing drainage hollows, but across hills and valleys, lakes and arms of the sea. Under existing circumstances no ordinary action of nature can occasion such effects; it is therefore a question of great importance whether in antient times the circumstances of physical geography were so different as to allow of the effects being performed by *ordinary* action, or whether an *extraordinary* action must be appealed to. The latter opinion has been held by diluvialists, reasoning on the distribution of gravel and large boulders of rock dispersed from the Alps and the Cumbrian mountains; but various attempts have been made to explain the phenomena by supposed changes of physical geography, the aid of icebergs, &c. For determining this and such questions it should be examined—whether the gravel, &c., contains remains of organic beings; whether these are of land quadrupeds, land shells, land plants, or marine shells, bones of whales, dolphins, &c., in order to know whether the currents of water were derived from surface drainage or the movement of the sea. It is important to find out whether the gravel was deposited in still or agitated, in deep or shallow water, in lakes, flood-channels, or the sea: whether it now rests in included hollows, or in insular hills;—whether marine deposits of gravel alternate with others attributed to fresh-water currents;—whether gravel of local origin lies over or under other gravel brought from a distance.

These and other points of inquiry, suggested by Mr. H. Strickland in a paper read to the British Association at Liverpool in 1837, deserve careful attention, and require for their solution no unusual experience in geological investigation. [SUPERFICIAL DEPOSITS.]

GRAVELINES. [NORD.]

GRAVER. [ENGRAVING, vol. viii., p. 441.]

GRAVES, RICHARD, was born at Mickleton, in Gloucestershire, in 1715, received his academical education at Pembroke College, Oxford, and in 1736 was elected fellow of All Souls. Having taken orders and married, he obtained, about 1750, the rectory of Claverton, near Bath, in Somersetshire, where the remainder of his long life was spent. He engaged in private tuition with credit and success, and still found time to devote to polite literature. (See the list of his works (too long and insignificant for insertion) in the *Gent. Mag.*, vol. lxxiv., p. 1166, copied by Chalmers.) The only one now remembered (and that by few) is the 'Spiritual Quixote,' 1772. This novel was written as a satire on the Methodists; it is clever, lively, and amusing, and shows that Mr. Graves possessed considerable power as a writer of fiction. But like other occasional publications its popularity passed with the interest of the subject: not to say that the recognised respectability and utility of the Methodist clergy have rendered society in general less inclined to look favourably on a violent attack on the whole body, founded on the follies or vices which individuals may have shown; and the profuse and somewhat irreverent introduction of scriptural language is offensive to a large class of readers. Mr. Graves was beloved in society for his gay ready wit and good humour: he was intimate with Shenstone and other writers admired in their day, but now forgotten. He died at Claverton, November 23, 1804, nearly ninety years old.

GRAVESANDE, S'. [S'GRAVESANDE.]

GRAVESEND. [KENT.]

GRAVI'NA, GIOVANNI VINCENZO, born at Ruggiano in Calabria in 1664, studied at Naples, where he devoted himself chiefly to the investigation of jurisprudence, antient and modern. He afterwards went to Rome, where he and Crescimbeni were the founders of the Accademia degli Arcadi, which has continued ever since. In 1698 Innocent XII. appointed him professor of civil and canon law in the University of Rome. Gravina gave up his chair in 1714, and visited Calabria, but after two years he returned to Rome, where he refused several offers of professorships in various German universities. Victorius Amadeus, king of Sardinia, having offered him the chair of law in the University of Turin, together with the prefectship of that institution, Gravina was preparing to remove thither, but he died in January, 1718. He left all his property to his disciple Trapassi, commonly called Metastasio, whom he had brought up in his house like a son. The principal work of Gravina, for which he ranks high among jurists, is the 'Originum Juris Civilis, libri tres.' In the first book, 'De Ortu et Progressu Juris Civilis,' he traces the origin of jurisprudence from the first institutions of Rome, from the division of the population into orders, from the political condition of the infant state, and from the laws of the kings collected afterwards by Sextus Papirius, and known by the name of Jus Papirianum, of which fragments have been preserved. This book is in fact an elaborate treatise on the early civil and political system of Rome. In the second book, 'De Jure Naturali Gentium, et XII. Tabularum,' he follows the progress of legislation in Rome under the Republic, and he shows the connection between the Roman laws and the general principles of justice, which the Romans seem to have kept in view in their civil enactments more than any other nation of antiquity. The author also carefully illustrates the fragments of the Twelve Tables. The third book, 'De Legibus et Senatus Consultis,' completes this sketch of Roman jurisprudence; and the author treats at length of the opinions or decisions of the Roman

jurists, who were often consulted by the senate, and whose 'Responsa' form a most important part of the Roman law. He also treats of the modern jurists who lived after the restoration of the Roman law in the West, beginning from Irnerius, or Varnerius, a professor of Bologna in the eleventh century, who, at the desire of the Countess Mathilda, revived the knowledge of the Justinian Code many years before the reported discovery of the Pandects by the Pisans at Amalfi, and passing in review those who followed in successive ages down to his own time. The publication of the 'Originum Juris Civilis' attracted universal attention throughout Europe, and Montesquieu and other competent judges have bestowed praise on the manner in which the author handles his subjects, and the many luminous principles and happy definitions contained in the work. The best edition is that of Leipzig, 2 vols. 4to., 1737. It has been translated into French under the title of 'Esprit des Lois Romaines,' Paris, 1766. Gravina wrote also, 1. 'De Romano Imperio liber singularis,' an inferior performance, in which the author seems intent on flattering the vanity of the modern Romans; 2. 'Della Ragion Poetica,' being a treatise on the art of poetry; 3. 'Institutiones Canonicæ,' published at Turin after his death; besides several very inferior tragedies, some orations, and other opuscula: among others, a curious dialogue between casuistry and heresy, whom he represents as two sisters bent upon sapping the foundations of Christianity, the latter by attacking faith, and the former by destroying charity. Fabbroni published a biography of Gravina. (Corniani, *Secoli della Letteratura Italiana*, art. 'Gravina.')

GRAVITATION. Section I.—*On the Rules for calculating Attraction, or, the Law of Gravitation.*

(1.) The principle upon which the motions of the earth, moon, and planets are calculated is this: Every particle of matter *attracts* every other particle. That is, if there were a single body alone, and at rest, then, if a second body were brought near it, the first body would immediately begin to move towards the second body. Just in the same manner, if a needle is at rest on a table, and if a magnet is brought near it, the needle immediately begins to move towards the magnet, and we say that the magnet attracts the needle. But magnetic attraction belongs only to certain bodies: whereas the attraction of which we speak here belongs to all bodies of every kind: metals, earths, fluids, and even the air and gases are equally subject to its influence.

(2.) The most remarkable experiments which prove that bodies attract each other are a set of experiments made at the end of the last century by Mr. Cavendish. Small leaden balls were supported on the ends of a rod which was suspended at the middle by a slender wire; and when large leaden balls were brought near to them, it was found that the wire was immediately twisted by the motion of the balls. But the results of this experiment are striking, principally because they are unusual; the ordinary force of gravity serves quite as well to prove the existence of some such power. For when we consider that the earth is round, and that, on all parts of it, bodies, as soon as they are at liberty, fall in directions perpendicular to its surface, (and therefore fall in opposite directions at the places which are diametrically opposite,) we are compelled to allow that there is a force such as we call attraction, either directed to the centre of the earth, or produced by a great number of small forces, directed to all the different particles composing the earth. The peculiar value of Cavendish's experiment consists in showing that there is a small force directed to every different particle of the earth.

(3.) But it is necessary to state distinctly the rules by which this attraction is regulated, and by which it may be calculated; or (as it is technically called) *the law of gravitation*. Before we can do this, we must determine which of the effects of attraction we choose to take as its measure. For there are two distinct effects: one is the *pressure* which it produces upon any obstacle that keeps the body at rest; the other is the *space through which it draws the body in a certain time*, if the obstacle is removed and the body set at liberty. Thus, to take the ordinary force of gravity as an instance: we might measure it by the pressure which is produced on the hand by a lump of lead held in the hand; or we might measure it by the number of inches through which the lump of lead would fall in a second of time after the hand is opened (as the pressure and fall are both occasioned by gravity). But there is this difference between the two measures: if we adopted the first, since a large lump of lead weighs more than a small one, we should find a different measure by the use of every different piece of lead; whereas, if we adopt the second, since it is well established by careful and accurate experiments that large and small lumps of lead, stones, and even feathers, fall through the same number of inches in a second of time, (when the resistance of the air, &c., is removed,) we shall get the same measure for gravity, whatever body we suppose subject to its influence. The consistence and simplicity of the measure thus obtained incline us to adopt it in every other case; and thus we shall say, *Attraction is measured by the space through which it draws a body in one second of time after the body is set at liberty.*

(4.) Whenever we speak, therefore, of calculating attraction, it must be understood to mean calculating the number of inches, or feet, through which the attraction draws a body in one second of time.

(5.) Now the first rule is this: 'The attraction of one body upon another body does not depend on the mass of the body which is attracted, but is the same whatever be the mass of the body so attracted, if the distances are the same.'

(6.) Thus Jupiter attracts the sun, and Jupiter attracts the earth also; but though the sun's mass is three hundred thousand times as great as the earth's, yet the attraction of Jupiter on the sun is exactly equal to his attraction on the earth, when the sun and the earth are equally distant from Jupiter. In other words, (the attraction being measured in conformity with the definition above,) when the sun and the earth are at equal distances from Jupiter, the attraction of Jupiter draws the sun through as many inches, or parts of an inch, in one second of time as it draws the earth in the same time.

(7.) The second rule is this: 'Attraction is proportional to the mass of the body which attracts, if the distances of different attracting bodies be the same.'

(8.) Thus, suppose that the sun and Jupiter are at equal distances from Saturn; the sun is about a thousand times as big as Jupiter; then whatever be the number of inches through which Jupiter draws Saturn in one second of time, the sun draws Saturn in the same time through a thousand times that number of inches.

(9.) The third rule is this: 'If the same attracting body act upon several bodies at different distances, the attractions are inversely proportional to the square of the distances from the attracting body.'

(10.) Thus the earth attracts the sun, and the earth also attracts the moon; but the sun is four hundred times as far off as the moon, and therefore, the earth's attraction on the sun is only $\frac{1}{160000}$th part of its attraction on the moon; or, as the earth's attraction draws the moon through about $\frac{1}{20}$th of an inch in one second of time, the earth's attraction draws the sun through $\frac{1}{3200000}$th of an inch in one second of time. In like manner, supposing Saturn ten times as far from the sun as the earth is, the sun's attraction upon Saturn is only one hundredth part of his attraction on the earth.

(11.) The same rule holds in comparing the attractions which one body exerts upon another, when, from moving in different paths, and with different degrees of swiftness, their distance is altered. Thus Mars, in the spring of 1833, was twice as far from the earth as in the autumn of 1832; therefore, in the spring of 1833, the earth's attraction on Mars was only one-fourth of its attraction on Mars in the autumn of 1832. Jupiter is three times as near to Saturn, when they are on the same side of the sun as when they are on opposite sides; therefore, Jupiter's attraction on Saturn, and Saturn's attraction on Jupiter, are nine times greater when they are on the same side of the sun than when they are on opposite sides.

(12.) The reader may ask, How is all this known to be true? The best answer is, perhaps, the following: We find that the force which the earth exerts upon the moon bears the same proportion to gravity on the earth's surface which it ought to bear in conformity with the rule just given. For the motions of the planets, calculations are made, which are founded upon these laws, and which will enable us to predict their places with considerable accuracy, if the laws are true, but which would be much in error if the laws were false. The accuracy of astronomical observations is carried to a degree that can scarcely be imagined; and by means of these we can every day compare the observed place of a planet with the place which was calculated beforehand, according to the law of gravitation. It is found that they

agree so nearly as to leave no doubt of the truth of the law. The motion of Jupiter, for instance, is so perfectly calculated, that astronomers have computed ten years beforehand the time at which it will pass the meridian of different places, and we find the predicted time correct within half a second of time.

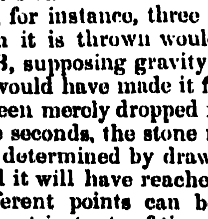
SECTION II.—*On the Effect of Attraction upon a Body which is in motion, and on the Orbital Revolutions of Planets and Satellites.*

(13.) We have spoken of the simplest effects of attraction, namely, the production of pressure, if the matter on which the attraction acts is supported, (as when a stone is held in the hand,) and the production of motion if the matter is set at liberty (as when a stone is dropped from the hand). And it will easily be understood, that when a body is projected, or thrown, in the same direction in which the force draws it, (as when a stone is thrown downwards,) it will move with a greater velocity than either of these causes separately would have given it; and if thrown in the direction opposite to that in which the force draws it, (as when a stone is thrown upwards,) its motion will become slower and slower, and will, at last, be turned into a motion in the opposite direction. We have yet to consider a case much more important for astronomy than either of these: Suppose that a body is projected in a direction *transverse to*, or *crossing*, the direction in which the force draws it, how will it move?

(14.) The simplest instance of this motion that we can imagine is the motion of a stone when it is thrown from the hand in a horizontal direction, or in a direction nearly horizontal. We all know that the stone soon falls to the ground; and if we observe its motion with the least attention, we see that it does not move in a straight line. It begins to move in the direction in which it is thrown; but this direction is speedily changed; it continues to change gradually and constantly, and the stone strikes the ground, moving at that time in a direction much inclined to the original direction. The most powerful effort that we can make, even when we use artificial means, (as in producing the motion of a bomb or a cannon-ball,) is not sufficient to prevent the body from falling at last. This experiment therefore will not enable us immediately to judge what will become of a body (as a planet) which is put in motion at a great distance from another body, which attracts it, (as the sun); but it will assist us much in judging generally what is the nature of motion when a body is proje[illegible] n a direction transverse to the direction in which the f[illegible] acts on it.

(15.) It appears then that the general nature of the motion is this: the body describes a curved path, of which the first part has the same direction as the line in which it is projected. The circumstances of the motion of the stone may be calculated with the utmost accuracy from the following rule, called the second law of motion, (the accuracy of which has been established by many simple experiments, and many inferences from complicated motion). If A, *fig.* 1, is the point from which the stone was thrown, and

Fig. 1.



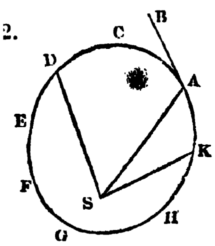
A B the direction in which it was thrown; and if we wish to know where the stone will be at the end of any particular time, (suppose, for instance, three seconds,) and if the velocity with which it is thrown would, in three seconds, have carried it to B, supposing gravity not to have acted on it; and if gravity would have made it fall from A to C, supposing it to have been merely dropped from the hand; then, at the end of three seconds, the stone really will be at the point D, which is determined by drawing B D parallel and equal to A C; and it will have reached it by a curved path A D, of which different points can be determined in the same way for different instants of time.

(16.) The calculation of the stone's course is easy, because, during the whole motion of the stone, gravity is acting upon it with the same force and in the same direction. The circumstances of the motion of a body attracted by a planet, or by the sun, (where the force, as we have before mentioned, is inversely proportional to the square of the distance, and therefore varies as the distance alters, and is not the same, either in its amount or in its direction, at the point D, as it is at the point C,) cannot be computed by the same simple method. But the same method will apply, provided we restrict the intervals for which we make the calculations to times so short, that the alterations in the amount of the force, and in its direction, during each of those times, will be very small. Thus, in the motion of the earth, as affected by the attraction of the sun, if we used the process that we have described, to find where the earth will be at the end of a month from the present time, the place that we should find would be very far wrong; if we calculated for the end of a week, since the direction of the force (always directed to the sun) and its magnitude (always proportional inversely to the square of the distance from the sun) would have been less altered, the circumstances would have been more similar to those of the motion of the stone, and the error in the place that we should find would be much less than before; if we calculated by this rule for the end of a day, the error would be so small as to be perceptible only in the nicest observations; and if we calculated for the end of a minute, the error would be perfectly insensible.

(17.) Now a method of calculation has been invented, which amounts to the same as making this computation for every successive small portion of time, with the correct value of the attractive force and the correct direction of force at every particular portion of time, and finding thus the place where the body will be at the end of any time that we may please to fix on, without the smallest error. The rules to which this leads are simple: but the demonstration of the rules requires the artifices of advanced science. We cannot here attempt to give any steps of this demonstration; but our plan requires us to give the results.

(18.) It is demonstrated that if a body (a planet for instance) is by some force projected from A, *fig.* 2, in the direction A B, and if the attraction of the sun, situated at S, begins immediately to act on it, and continues to act on

Fig. 2.



it according to the law that we have mentioned, (that is, being inversely proportional to the square of its distance from S, and always directed to S); and if no other force whatever but this attraction acts upon the body; then the body will move in one of the following curves—a circle, an ellipse, a parabola, or a hyperbola.

In every case the curve will, at the point A, have the same direction as the line A B; or, (to use the language of mathematicians,) A B will be a tangent to the curve at A.

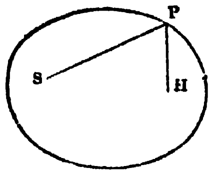
The curve cannot be a circle unless the line A B is perpendicular to S A, and, moreover, unless the velocity with which the planet is projected is neither greater nor less than one particular velocity determined by the length of S A and the mass of the body S. If it differs little from this particular velocity, (either greater or less,) the body will move in an ellipse: but if it is much greater, the body will move in a parabola or a hyperbola.

If A B is oblique to S A, and the velocity of projection is small, the body will move in an ellipse; but if the velocity is great, it may move in a parabola or hyperbola, but not in a circle.

If the body describe a circle, the sun is the centre of the circle.

If the body describe an ellipse, the sun is not the centre of the ellipse, but one focus. (The method of describing an ellipse is to fix two pins in a board, as at S and H, *fig.* 3; to fasten a thread S P H to them, and to keep this thread stretched by the point of a pencil, as at P: the pencil will trace out an ellipse, and the places of the pins S and H will be the two focuses.)

Fig. 3.



If the body describe a parabola or hyperbola, the sun is in the focus.

(19.) The planets describe ellipses which are very little flattened, and differ very little from circles. Three or four comets describe very long ellipses; and nearly all the others that have been observed are found to move in curves which cannot be distinguished from parabolas. There is reason to think that two or three comets which have been observed move in hyperbolas. But as we do not propose, in this treatise, to enter into a discussion on the motions of comets, we shall confine ourselves to the consideration of motion in an ellipse.

(20.) Everything that has been said respecting the motion of a planet, or body of any kind, round the sun, in consequence of the sun's attraction according to the law of gravitation, applies equally well to the motion of a satellite about a planet, since the planet attracts with a force following the same law (though smaller) as the attraction of the sun. Thus the moon describes an ellipse round the earth, the earth being the focus of the ellipse; Jupiter's satellites describe each an ellipse about Jupiter, and Jupiter is in one focus of each of those ellipses; the same is true of the satellites of Saturn and Uranus.

(21.) In stating the suppositions on which the calculations of orbits are made, we have spoken of a force of attraction, and a force by which a planet is projected. But the reader must observe that the nature of these forces is wholly different. The force of attraction is one which acts constantly and steadily without a moment's intermission (as we know that gravity to the earth is always acting): the force by which the body is projected is one which we suppose to be necessary at some past time to account for the planet's motion, but which acts no more. The planets *are in motion*, and it is of no consequence to our inquiry how they received this motion, but it is convenient, for the purposes of calculation, to suppose that, at some time, they received an impulse of the same kind as that which a stone receives when thrown from the hand; and this is the whole meaning of the term 'projectile force.'

(22.) From the same considerations it will appear that, if in any future investigations we should wish to ascertain what is the orbit described by a planet after it leaves a certain point where the velocity and direction of its motion are known, we may suppose the planet to be projected from that point with that velocity and in that direction. For it is unimportant by what means the planet acquires its velocity, provided it has such a velocity there.

(23.) We shall now allude to one of the points which, [illegible] simple and natural consequences of the law of gravitation.

(24.) The force of attraction, we have said, is inversely proportional to the square of the distance, and is therefore greatest when the distance is least. It would seem then, at first sight, that when a planet has approached most nearly to the sun, as the sun's attraction is then greater than at any other time, the planet must inevitably fall to the sun. But we assert that the planet begins then to recede from the sun, and that it attains at length as great a distance as before, and goes on continually retracing the same orbit. How is this receding from the sun to be accounted for?

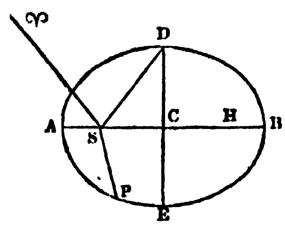
(25.) The explanation depends on the increase of velocity as the planet approaches to the point where its distance from the sun is least, and on the considerations by which we determine the form of the curve which a certain attracting force will cause a planet to describe. In explaining the motion of a stone thrown from the hand, to which the motion of a planet for a very small time is exactly similar, we have seen that the deflection of the stone from the straight line in which it began to move is exactly equal to the space through which gravity could have made it fall in the same time from rest, whatever were the velocity which it was thrown. Consequently, when the stone is own with very great velocity, it will have gone a great distance before it is much deflected from the straight line, and therefore its path will be very little curved; a fact familiar to the experience of every one. The same thing holds with regard to the motion of a planet; and thus the curvature of any part of the orbit which a planet describes will not depend simply upon the force of the sun's attraction, but will also depend on the velocity with which the planet is moving. The greater is the velocity of the planet at any point of its orbit, the less will the orbit be curved at that part. Now if we refer to *fig.* 2, we shall see that, supposing the planet to have passed the point C with so small a velocity that the attraction of the sun bends its path very much, and causes it immediately to begin to approach towards the sun; the sun's attraction will necessarily increase its velocity as it moves through D, E, and F. For the sun's attractive force on the planet, when the planet is at D, is acting in the direction D S, and it is plain that (on account of the small inclination of D E to D S) the force pulling in the direction D S helps the planet along in its path D E, and thereby increases its velocity. Just as when a ball rolls down a sloping bank, the force of gravity (whose direction is not much inclined to the bank) helps the ball down the bank, and thereby increases its velocity. In this manner, the velocity of the planet will be continually increasing as the planet passes through D, E, and F; and though the sun's attractive force (on account of the planet's nearness) is very much increased, and tends, therefore, to make the orbit more curved, yet the velocity is so much increased that, on that account, the orbit is not more curved than before. Upon making the calculation more accurately, it is found that the planet, after leaving C, approaches to the sun more and more rapidly for about a quarter of its time of revolution; then for about a quarter of its time of revolution the velocity of its approach is constantly diminishing: and at half the periodic time after leaving C, the planet is no longer approaching to the sun; and its velocity is so great, and the curvature of the orbit in consequence so small, (being, in fact, exactly the same as at C,) that it begins to recede. After this it recedes from the sun by exactly the same degrees by which it before approached it.

(26.) The same sort of reasoning will show why, when the planet reaches its greatest distance, where the sun's attraction is least, it does not altogether fly off. As the planet passes along H, K, A, the sun's attraction (which is always directed to the sun) retards the planet in its orbit, just as the force of gravity retards a ball which is bowled up a hill; and when it has reached C, its velocity is extremely small; and, therefore, though the sun's attraction at C is small, yet the deflection which it produces in the planet's motion is (on account of the planet's slowness there) sufficient to make its path very much curved, and the planet approaches the sun, and goes over the same orbit as before.

(27.) The following terms will occur perpetually in the rest of this article, and it is therefore desirable to explain them now.

Let S and H, *fig.* 4, be the focuses of the ellipse A E B D;

Fig. 4.



draw the line A B through S and H; take C the middle point between S and H, and draw D C E perpendicular to A C B. Let S be that focus which is the place of the sun, (if we are speaking of a planet's orbit,) or the place of the planet, (if we are speaking of a satellite's orbit).

Then A B is called the *major axis* of the ellipse.

C is the *centre*.

A C or C B is the *semi-major axis*. This is equal in length to S D; it is sometimes called the *mean distance*, because it is half-way between A S (which is the planet's smallest distance from S) and B S (which is the planet's greatest distance from S).

D E is the *minor axis*, and D C or C E the *semi-minor axis*.

A is called the *perihelion*, (if we are speaking of a planet's orbit); the *perigee*, (if we are speaking of the orbit described by our moon about the earth); the *perijove*, (if we are speaking of the orbit described by one of Jupiter's satellites round Jupiter); or the *perisaturnium*, (if we are speaking of the orbit described by one of Saturn's satellites about Saturn).

B, in the orbit of a planet, is called the *aphelion;* in the moon's orbit it is called the *apogee;* in the orbit of one of Jupiter's satellites, we shall call it the *apojove.*

A and B are both called *apses;* and the line A B, or the major axis, is sometimes called the *line of apses.*

S C is sometimes called the *linear excentricity;* but it is more usual to speak only of the proportion which S C bears to A C, and this proportion, expressed by a number, is called the *excentricity*. Thus, if S C were one-third of A C, we should say, that the excentricity of the orbit was ⅓, or 0·3333.

If S ♈ is drawn towards a certain point in the heavens, called the *first point of Aries*, then the angle ♈ S A is called the *longitude of perihelion*, (or of perigee, or of perijove, &c.).

If P is the place of the planet in its orbit at any particular time, then the angle ♈ S P is its *longitude* at that time, and the angle A S P is its *true anomaly*. (The longitude of the planet is, therefore, equal to the sum of the longitude of the perihelion, and the true anomaly of the planet.) The line S P is called the *radius vector*.

In all our diagrams it is to be understood, that the planet, or satellite, moves through its orbit in the direction opposite to the motion of the hands of a watch. This is the direction in which all the planets and satellites would appear to move, if viewed from any place on the north side of the planes of their orbits.

The time in which the planet moves from any one point of the orbit through the whole orbit, till it comes to the same point again, is called the planet's *periodic time*.

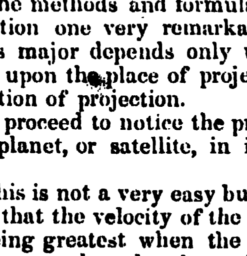
(28.) If we know the mass of the central body, and if we suppose the revolving body to be projected at a certain place in a known direction with a given velocity, the length of the axis major, the excentricity, the position of the line of apses, and the periodic time, may all be calculated. We cannot point out the methods and formulæ used for these, but we may mention one very remarkable result. The length of the axis major depends only upon the velocity of projection, and upon the place of projection, and not at all upon the direction of projection.

(29.) We shall proceed to notice the principle on which the motion of a planet, or satellite, in its orbit, is calculated.

It is plain that this is not a very easy business. We have already explained, that the velocity of the planet in its orbit is not uniform, (being greatest when the planet's distance from the sun is least, or when the planet is at perihelion); and it is obvious, that the longitude of the planet increases very irregularly; since, when the planet is near to the sun, its actual motion is very rapid, and, therefore, the increase of longitude is extremely rapid; and when the planet is far from the sun, its actual motion is slow, and, therefore, the increase of longitude is extremely slow. The rule which is demonstrated by theory, and which is found to apply precisely in observation, is this:—The areas described by the radius vector are equal in equal times. This is true, whether the force be inversely as the square of the distance from the central body, or be in any other proportion, provided that it is directed to the central body.

(30.) Thus, if in one day a planet, or a satellite, moves from A to *a*, *fig.* 5; in the next day it will move from *a* to

Fig. 5.



b, making the area *a* S *b* equal to A S *a;* in the third day it will move from *b* to *c*, making the area *b* S *c* equal to A S *a* or *a* S *b*, and so on.

(31.) Upon this principle mathematicians have invented methods of calculating the place of a planet or satellite, at any time for which it may be required. These methods are too troublesome for us to explain here; but we may point out the meaning of two terms which are frequently used in these computations. Suppose, for instance, as in the figure, that the planet, or satellite, occupies ten days in describing the half of its orbit, A *a b c d e f g h i* B, or twenty days in describing the whole orbit; and suppose that we wished to find its place at the end of three days after leaving the perihelion. If the orbit were a circle, the planet would in three days have moved through an angle of 54 degrees. If the excentricity of the orbit were small (that is, if the orbit did not differ much from a circle), the angle through which the planet would have moved would not differ much from 54 degrees. The excentricities of all the orbits of the planets are small; and it is convenient, therefore, to begin with the angle 54° as one which is not very erroneous, but which will require some correction. This angle (as 54°), which is proportional to the time, is called the *mean anomaly;* and the correction which it requires, in order to produce the true anomaly, is called the *equation of the centre.* If we examine the nature of the motion, while the planet moves from A to B, it will be readily seen, that, during the whole of that time, the angle really described by the planet is *greater* than the angle which is proportional to the time, or the equation of the centre is to be *added* to the mean anomaly, in order to produce the true anomaly; but while the planet moves in the other half of the orbit, from B to A, the angle really described by the planet is *less* than the angle which is proportional to the time, or the equation of the centre is to be *subtracted from* the mean anomaly, in order to produce the true anomaly.

(32.) The sum of the mean anomaly and the longitude of perihelion is called the *mean longitude* of the planet. It is evident, that if we add the equation of the centre to the mean longitude, while the planet is moving from A to B, or subtract it from the mean longitude, while the planet is moving from A to B, as in (31.), we shall form the true longitude.

(33.) The reader will see, that when the planet's true anomaly is calculated, the length of the radius vector can be computed from a knowledge of the properties of the ellipse. Thus the place of the planet, for any time, is perfectly known. This problem has acquired considerable celebrity under the name of Kepler's problem.

(34.) There remains only one point to be explained regarding the undisturbed motion of planets and satellites; namely, the relation between a planet's periodic time and the dimensions of the orbit in which it moves.

Now, on the law of gravitation it has been demonstrated from theory, and it is fully confirmed by observation, that the periodic time does not depend on the excentricity, or on the perihelion distance, or on the aphelion distance, or on any element except the *mean distance* or semi-major axis. So that if two planets moved round the sun, one in a circle, or in an orbit nearly circular, and the other in a very flat ellipse; provided their mean distances were equal, their periodic times would be equal. It is demonstrated also, that for planets at different distances, the relation between the periodic times and the mean distances is the following: The squares of the numbers of days (or hours, or minutes, &c.) in the periodic times have the same proportion as the cubes of the numbers of miles (or feet, &c.) in the mean distances.

(35.) Thus the periodic time of Jupiter round the sun is 4332·7 days, and that of Saturn is 10759·2 days; the squares of these numbers are 18772289 and 115760385. The mean distance of Jupiter from the sun is about 487491000 miles, and that of Saturn is about 893955000 miles; the cubes of these numbers are 1158496 (20 ciphers), and 7144088 (20 ciphers). On trial it will be found, that 18772289 and 115760385 are in almost exactly the same proportion as 1158496 and 7144088.

(36.) In like manner, the periodic times of Jupiter's third and fourth satellites round Jupiter are 7·15455 and 16·68877 days; the squares of these numbers are 51·1876 and 278·515. Their mean distances from Jupiter are 670080 and 1178560 miles; the cubes of these numbers are 300866 (12 ciphers), and 1637029 (12 ciphers), and the proportion of 51·1876 to 278·515 is almost exactly the same as the proportion of 300866 to 1637029.

(37.) It must however be observed that this rule applies in comparing the periodic times and mean distances, *only* of bodies which revolve round the *same* central body. Thus the rule applies in comparing the periodic times and mean

distances of Jupiter and Saturn, because they both revolve round the sun; it applies in comparing the periodic times and mean distances of Jupiter's third and fourth satellites, because they both revolve round Jupiter; but it would not apply in comparing the periodic time and mean distance of Saturn revolving round the sun with that of Jupiter's third satellite revolving round Jupiter.

(38.) In comparing the orbits described by different planets, or satellites, round different centres of force, theory gives us the following law:—The cubes of the mean distances are in the same proportion as the products of the mass by the square of the periodic time. Thus, for instance, the mean distance of Jupiter's fourth satellite from Jupiter is 1178560 miles; its periodic time round Jupiter is 16·68877 days; the mean distance of the earth from the sun is 93726900 miles; its periodic time round the sun is 365·2564 days; also the mass of Jupiter is $\frac{1}{1050}$th the sun's mass. The cubes of the mean distances are respectively 1637029 (12 ciphers), and 823365 (18 ciphers); the products of the squares of the times by the masses are respectively 0·265252 and 133412; and these numbers are in the same proportion as 1637029 (12 ciphers), and 823365 (18 ciphers).

(39.) The three rules—that planets move in ellipses, that the radius vector in each orbit passes over areas proportional to the times, and that the squares of the periodic times are proportional to the cubes of the mean distances,—are commonly called *Kepler's laws*. They were discovered by Kepler from observation, before the theory of gravitation was invented; they were first explained from the theory by Newton, about A.D. 1680.

(40.) The last of these is not strictly true, unless we suppose that the central body is absolutely immovable. This however is evidently inconsistent with the principles which we have laid down in Section I. In considering the motion, for instance, of Jupiter round the sun, it is necessary to consider that, while the sun attracts Jupiter, Jupiter is also attracting the sun. But the planets are so small in comparison with the sun (the largest of them, Jupiter, having less than one-thousandth part of the matter contained in the sun), that in common illustrations there is no need to take this consideration into account. For nice astronomical purposes it is taken into account in the following manner:—The motion which the attraction of Jupiter produces in the sun is less than the motion which the attraction of the sun produces in Jupiter, in the same proportion in which Jupiter is smaller than the sun. If the sun and Jupiter were allowed to approach one another, their rate of approach would be the *sum* of the motions of the sun and Jupiter, and would therefore be greater than their rate of approach, if the sun were not moveable, in the same proportion in which the sum of the masses of the sun and Jupiter is greater than the sun's mass; that is, the rate of approach of the sun and Jupiter, both being free, is the same as the rate of approach would be if the sun were fixed, provided the sun's mass were increased by adding Jupiter's mass to it. Consequently, in comparing the orbits described by different planets round the sun, we must use the rule just laid down, supposing the central force to be the attraction of a mass equal to the sum of the sun and the planet; and thus we get a proportion which is rigorously true: for different planets, or even for different bodies revolving round different centres of force, the cubes of the mean distances are in the same proportion as the products of the square of the periodic time by the sum of the masses of the attracting and attracted body.

SECTION III.—*General Notions of Perturbation; and Perturbation of the Elements of Orbits.*

(41.) We have spoken of the motion of two bodies (as the sun and a planet) as if no other attracting body existed. But, as we have stated in Section I., every planet and every satellite attracts the sun and every other planet and satellite. It is plain now that, as each planet is attracted very differently at different times by the other planets whose position is perpetually varying, the motion is no longer the same as if it was only attracted by the sun. The planets therefore do not move exactly in ellipses; the radius vector of each planet does not pass over areas exactly proportional to the times; and the proportion of the cube of the mean distance to the product of the square of the periodic time by the sum of the masses of the sun and the planet, is not strictly the same for all. Still the disturbing forces of the other planets are so small in comparison with the attraction of the sun, that these laws are very nearly true; and (except for our moon and the other satellites) it is only by accurate observation, continued for some years, that the effects of perturbation can be made sensible.

(42.) The investigation of the effects of the disturbing forces will consist of two parts: the examination into the effects of disturbing forces generally upon the motion of a planet, and the examination into the kind of disturbing force which the attraction of another planet produces. We shall commence with the former; we shall suppose that a planet is revolving round the sun, the sun being fixed, (a supposition made only for present convenience,) and that some force acts on the planet without acting on the sun, (a restriction introduced only for convenience, and which we shall hereafter get rid of).

(43.) The principle upon which we shall explain the effect of this force is that known to mathematicians by the name of *variation of elements*. The planet, as we have said, describes some curve which is not strictly an ellipse, or, indeed, any regularly formed curve. It will not even describe the same curve in successive revolutions. Yet its motion may be represented by supposing it to have moved in an ellipse, provided we suppose the elements of the ellipse to have been perpetually altering. It is plain that by this contrivance any motion whatever may be represented. By altering the major axis, the excentricity, and the longitude of perihelion, we may in many different ways make an ellipse that will pass through any place of the planet; and by altering them in some particular proportions, we may, in several ways, make an ellipse in which the direction of motion at the place of the planet shall be the same as the direction of the planet's motion. But there is only one ellipse which will pass exactly through a place of the planet, in which the direction of the motion at that place shall be exactly the same as the direction of the planet's motion, and in which the velocity (in order that a body may revolve in that ellipse round the sun) will be the same as the planet's real velocity. The dimensions and position of this ellipse may be conceived as follows: if at any instant we suppose the disturbing force to cease, and conceive the planet to be as it were projected with the velocity which it happens to have at that instant, the attraction of the sun or central body will cause it to describe the ellipse of which we are speaking. We shall in future mention this by the name of the *instantaneous ellipse.*

(44.) If the disturbing force ceases, the planet continues to revolve in the same ellipse, and the permanent ellipse coincides with the instantaneous ellipse corresponding to the instant when the disturbing force ceases.

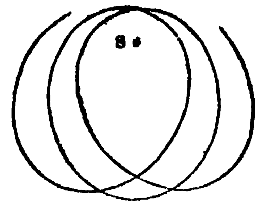
(45.) If the disturbing force continues to act, the dimensions of the instantaneous ellipse are continually changing; but in the course of a single revolution, (even for our moon,) the dimensions alter so little, that the motion in the instantaneous ellipse corresponding to any instant during that revolution will very nearly agree with the real motion during that revolution.

We shall now consider the effects of particular forces in altering the elements.

(46.) (I.) Suppose that the disturbing force is always directed to the central body. The effect of this would be nearly the same as if the attraction, or the mass of the central body, was increased. The result of this on the dimensions of the orbit will be different according to the part of the orbit where it begins to act, and may be gathered from the cases to be mentioned separately hereafter, (we do not insist on it at present, as there is no instance in the planetary system of such sudden commencement of force). But at all events the relation between the mean distance and the periodic time will not be the same as before; the time will be less for the same mean distance, or the mean distance greater for the same periodic time, than if the disturbing force did not act. (38.) If the disturbing force is always directed from the central body, the effect will be exactly opposite. If the disturbing force does not alter, except with the planet's distance, the planet will at every successive revolution describe an orbit of the same size. For, as we have stated (29.), the radius vector will in equal times pass over equal areas; and mathematicians have proved that, if the variation of force depends only on the distance, the velocity of the planet will depend only on the distance; and the consideration which determines

the greatest or least distance of the planet is, that the planet, moving with the velocity which is proper to the distance, cannot describe the proper area in a short time, unless it move in the direction perpendicular to the radius vector. This consideration will evidently give the same values for the greatest and least distances at every revolution. It may happen that all the greatest distances will not be at the same place; the body may describe such an orbit as that in *fig.* 6.

Fig. 6.



(47.) (II.) If, however, the disturbing force directed to the central body increases gradually and constantly during many revolutions, there is no difficulty in seeing that the planet will at every revolution be drawn nearer to the central body, and thus it will move, at every succeeding revolution, in a smaller orbit than at the preceding one; and will consequently perform its revolution in a shorter time. If the disturbing force directed to the central body diminishes, the orbit will become larger, and the periodic time longer. In the same manner, if the disturbing force is directed from the central body, a gradual increase of the disturbing force will increase the dimensions of the orbit and the periodic time, and a gradual diminution of the disturbing force will diminish the dimensions of the orbit and the periodic time.

(48.) (III.) Suppose that the disturbing force acts always in the direction in which the planet is moving. The reader might imagine at first sight that this would shorten the time of revolution. The effect however is exactly opposite. For in *fig.* 2, if the planet be projected from A, the reason that the sun's attraction is able to pull the planet in at C and make it approach to itself is, that the velocity of the planet is so small as to allow the force to curve the orbit much. If the velocity were greater, the orbit—as we have said in (25.)—would be *less curved* in every part, and would therefore pass on the *outside* of the orbit A C D E F. The effect then of a force in the direction of the planet's motion, which increases the planet's velocity, is to increase the size of its orbit; and the bigger the orbit is, the longer is the time of revolution. If the force acts continually, the time of revolution lengthens continually. If the disturbing force acts in the direction opposite to that in which the planet is moving, the effect is to make the orbit smaller, and to make the time of revolution shorter. The retardation produced by motion through extremely thin air is of this kind. It is found that a comet (known by the name of Encke's comet) which moves in an ellipse, whose length is not much greater than the diameter of Mars' orbit, performs every new revolution in a shorter time than the preceding one; and we infer from this circumstance that it experiences some resistance in its motion.

(49.) (IV.) There is one consideration of great importance in the estimation of the effects mentioned in (II.) and (III.). The alteration of the dimensions of the orbit produces an alteration in the periodic time, and this alters the planet's *mean motion*, or the number of degrees by which the mean longitude is increased in a given time, (suppose one year). The effects of these alterations are added together at every successive revolution, and thus may produce an alteration in the planet's mean longitude (which differs from the true longitude only by the equation of the centre) that is vastly more conspicuous than the alteration in the dimensions of the orbit. Suppose, for instance, that a disturbing force acted on a planet—(either a constant force in the direction of its motion, or a variable force in the direction of the radius vector,) such as to increase the mean distance by $\frac{1}{10000}$th part in 100 revolutions of the planet. This alteration of the planet's distance from the sun could hardly be discovered by the nicest observations. But as the mean distance has been altered in the proportion of 10000 : 10001, the periodic time will have been altered in the proportion of 10000 : 10001½ nearly, or the mean motion will have been altered in the proportion of 10001½ to 10000, or 1 : 0·99985 nearly. If this alteration has gone on uniformly, we may suppose the whole motion in the 100 revolutions to have been nearly the same as if the planet had moved with a mean motion, whose value is half way between the values of the first and the last, or 0·999925 × the original mean motion. Therefore, at the time when we should expect the planet to have made 100 revolutions, it will only have made 99·9925 revolutions, or will be *behind* the place where we expected to see it by 0·0075 revolution, or nearly three degrees; a quantity which could not fail to be noticed by the coarsest observer. To use a borrowed illustration, the alteration of the mean distance in an orbit produces the same kind of effect as the alteration of the length of a clock pendulum: which, though so small as to be insensible to the eye, will, in a few days, produce a very great effect on the time shown by the clock.

(50.) (V.) Now suppose the orbit of the planet or satellite to be an ellipse; and suppose a disturbing force directed to the central body to act upon the planet, &c. only when it is near its perihelion or perigee, &c. In *fig.* 7, let

Fig. 7.

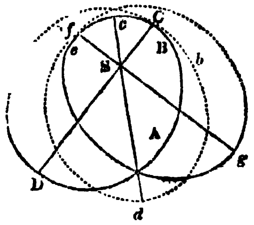
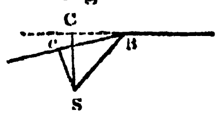


Fig. 7*.



A B be the curve in which the planet is moving, and let the dotted line B C D A represent the orbit in which it would have moved if no disturbing force had acted, C being the place of perihelion. At B let the disturbing force, directed towards S, begin to act, and let it act for a little while and then cease. The planet is at that place approaching toward the sun, and the direction of its motion makes an acute angle with S B. It is evident that the disturbing force, which draws the planet more rapidly towards the sun without otherwise affecting its motion, will cause it to move in a direction that makes a more acute angle with S B. The part of the new path, therefore, which is nearest to the sun (that is, the new perihelion) will be farther from B than the perihelion C of the orbit in which the planet would have moved. The reader's conception of this will be facilitated by supposing the orbit, instead of a curve, to be a straight line, as B C in *fig.* 7*, and the place of perihelion to be determined by letting fall a perpendicular S C from the sun upon the line: when it will be seen that if the disturbing force, acting towards S for a short time at B, changes the path of the planet from the direction B C to B *c*, the distance of the foot of the perpendicular S *c* from B is greater than that of S C. With a curved orbit the result is just the same. In other words, the planet, instead of describing B C *fig.* 7, will, in consequence of the action of the disturbing force, describe B *c*; and the place of perihelion, instead of C, will be *c*, a point more distant from B than C is. Now, if the disturbing force should not act again, the planet would move in an ellipse *c d b*, and the line of apses, instead of C S D, would be *c* S *d*. The line of apses has therefore twisted round in the same angular direction as that in which the planet was going; and this is expressed by saying that *the line of apses progresses*. If, after passing *c*, the disturbing force should again act for a little while, at *e* for instance, the recess of the planet from the sun would be diminished, its path would be more nearly perpendicular to the radius vector, and therefore the inclination of the path would be such as corresponds to a smaller distance from perihelion than the planet really has. That is, when the planet leaves *e*, the inclination of its path to the radius vector is greater than it would have been if the planet had continued to move in the orbit *c d b*, but is the same as if its perihelion had been at some such situation as *f*, supposing no disturbing force to act. Now let the disturbing force cease entirely to act; and the planet, which at *e* is moving as if it had come from the perihelion *f*, will continue to move as if it had come from the perihelion *f*; it will proceed, therefore, to describe an elliptic orbit in which *f* S *g* is the line of apses: the line of apses has been twisted round in the same direction as before, or the line of apses has still progressed. The effect then of a

disturbing force directed to the central body before and after passing the perihelion, is to make the line of apses progress.*

(51.) In the same manner it will be seen, that the effect of a disturbing force, directed from the central body before and after passing the perihelion, is to make the line of apses regress.

(52.) The motion of the planet, subject to such forces as we have mentioned, would be *nearly* the same as if it was revolving in an elliptic orbit, and this elliptic orbit was at the same time revolving round its focus, turning in the same direction as that in which the planet goes round, and always carrying it on its circumference. And this is the easiest way of representing to the mind the *general effect* of this motion; the *physical cause* is to be sought in such explanations as that above.

(53.) (VI.) Suppose a disturbing force directed to the centre, to act upon the planet when it is near aphelion. As the planet is going towards aphelion it is receding from the sun. The effect of the disturbing force is to diminish the rate of recess from the sun; and, therefore, to increase the inclination of the planet's path to the radius vector. The aphelion is the place where the planet's path is perpendicular to the radius vector. The effect of the disturbing force, then, which increases the inclination of the planet's path to the radius vector, will be to make that path perpendicular to the radius vector sooner than if the disturbing force had not acted. That is, the planet will be at aphelion sooner than it would have been if no disturbing force had acted. The aphelion has, as it were, gone backwards to meet the planet. If the disturbing force should entirely cease, the planet will move in an elliptic orbit, of which this new aphelion would be the permanent aphelion. The line passing through the aphelion has, therefore, twisted in a direction opposite to the planet's motion, or *the line of apses has regressed.* After passing aphelion, if the disturbing force still continues to act, the planet's approach to the sun will be quickened by the disturbing force, and, therefore, after some time, the planet's rate of approach will be greater than that corresponding, in an undisturbed orbit, to its actual distance from aphelion, and will be equal to that corresponding in an undisturbed orbit to a greater distance from aphelion. If, now, the disturbing force ceases, the planet, moving as if it came in an undisturbed orbit from an imaginary aphelion, will continue to move as if it came from that imaginary aphelion; and that imaginary aphelion having been at a greater distance behind the planet than the real aphelion, its place will be represented by saying that the line of apses has still regressed. The effect, then, of a disturbing force directed to the central body, before and after passing aphelion, is to make the line of apses regress.

(54.) In the same manner it will be seen, that the effect of a disturbing force, directed from the central body, before and after passing the aphelion, is to make the line of apses progress.

(55.) (VII.) Since a disturbing force, directed to the central body, or one directed from the central body, produces opposite effects with regard to the motion of the line of apses, according as it acts near perihelion or near aphelion, it is easy to perceive that there must be some place between perihelion and aphelion, where the disturbing force, directed to the central body, will produce no effect on the position of the line of apses. It is found by accurate investigation, that this point is the place where the radius vector is perpendicular to the line of apses.†

(56.) (VIII.) The effects mentioned above are greatest when the excentricity is small. Let us compare the two orbits A C B in *fig.* 8 and A C B in *fig.* 9, in one of which the excentricity is great and in the other small; suppose the disturbing force to act for a short time at the perihe-

Fig. 8.

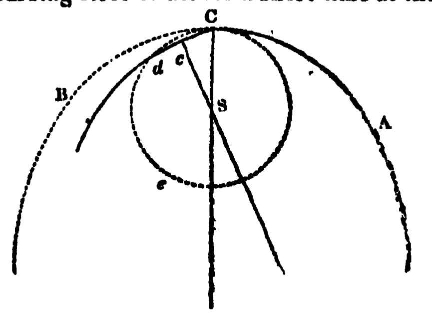
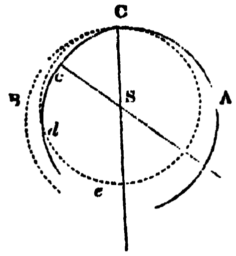


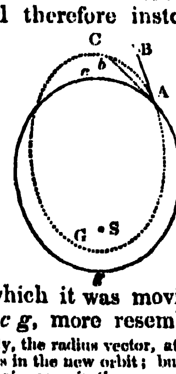
Fig. 9.



lion C, and to be nearly equal in the two orbits, so as to deflect the new path C *d* from the old orbit C B by equal angles in the two cases: with centre S describe the circle C *d e*. Then it is evident that the very excentric orbit C B, in *fig.* 8, is widely separated from the circle C *d e*, and therefore, when it is bent through a given angle to the position C *d*, it will intersect the circle at a point *d* not distant from C. In *fig.* 9, on the contrary, the orbit C B is not widely separated from the circle, and therefore, when it is bent through a given angle, its intersection *d* will be distant from C. Now the new perihelion *c* will be found, in both cases, by bisecting C *d;* and therefore its change of position in *fig.* 8, where the orbit is very excentric, is much less than in *fig.* 9, where the excentricity is small. Or we may state it thus:—The alteration of the place of perihelion, or aphelion, depends on the proportion which the alteration in the approach or recess produced by the disturbing force bears to the whole approach or recess; and is, therefore, greatest when the whole approach or recess is least; that is, when the orbit is little excentric.

(57.) (IX.) To judge of the effect which a disturbing force, directed to the sun, will produce on the excentricity of a planet's orbit, let us suppose the planet to have left its perihelion, and to be moving towards aphelion, and, consequently, to be receding from the sun, and now let the disturbing force act for a short time. This will cause it to recede from the sun more slowly than it would have receded without the action of the disturbing force; and, consequently, the planet, without any material alteration in its velocity,—and, therefore, without any material alteration in the major axis of its orbit (28.),—will be moving in a path more inclined to the radius vector than if the disturbing force had not acted. The planet may therefore be considered as projected from the point A, *fig.* 10, in the direction A *b* instead of A B, in which it was moving; and therefore instead of describing the

Fig. 10.



orbit A C G, in which it was moving before, it will describe an orbit A *c g*, more resembling a circle, or less

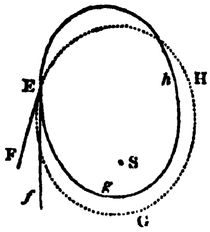
* This result, and those which follow immediately, may be inferred from the construction in Newton's 'Principia,' book i., sect. 3, prop. xvii. If we assume (as we suppose in all these investigations) the excentricity to be small, the disturbing force directed to the sun will not sensibly alter the planet's velocity, but will change the direction of its path at P, the place of action, (in Newton's figure); the length of P H, therefore, will not be altered, (since that length depends only on the velocity,) but its position will be altered, the position of P H being determined by making the angle R P H equal to the supplement of R P S. On trying the effects of this in different positions of P, and observing that the immediate effect of a disturbing force directed to the centre is to increase the rate of approach, or to diminish the rate of receding, and that the effect of a force directed from the centre is the opposite, all the cases in the text will be fully explained.

† To the reader who is familiar with Newton's 'Principia,' sect. 8, the following demonstration will be sufficient:—The disturbing force, which is entirely in the direction of the radius vector, will not alter the area described in a given time, and, therefore, will not alter the *latus rectum* (to the square root of which the area is proportional). But half the *latus rectum* of the undisturbed orbit is the radius vector at the supposed place of action of the disturbing force (since that radius vector is supposed perpendicular to the major axis). Therefore, half the *latus rectum* of the new orbit is the radius vector at the point in question; and, consequently, the radius vector, at the point in question, is perpendicular to the major axis in the new orbit; but it was so in the undisturbed orbit; and, therefore the major axes in the new orbit and the undisturbed orbit coincid

excentric than before. The effect therefore of a disturbing force directed to the centre, while a planet is moving from perihelion to aphelion, is to diminish the excentricity of the orbit.

(58.) If we suppose the planet to be moving from aphelion to perihelion, it is approaching to the sun; the disturbing force directed to the sun makes it approach more rapidly; its path is therefore less inclined to the radius vector than it would have been without the disturbing force; and this effect may be represented by supposing that at E, *fig.* 11, instead of moving in the direction E F in which it was moving, the planet is projected in the direction E *f*. In-

Fig. 11.



stead therefore of describing the ellipse E G H, in which it was moving before, it will describe such an ellipse as E *g h*, which is more excentric than the former. The effect therefore of a disturbing force directed to the centre, while a planet is moving from aphelion to perihelion, is to increase the excentricity of the orbit.

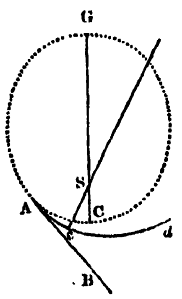
(59.) In a similar manner it will appear, that the effect of a disturbing force, directed from the centre, is to increase the excentricity as the planet is moving from perihelion to aphelion, and to diminish it as the planet moves from aphelion to perihelion.

(60.) (X.) Let us now lay aside the consideration of a force acting in the direction of the radius vector, and consider the effect of a force acting perpendicularly to the radius vector, in the direction in which the planet is moving. And first, its effect on the position of the line of apses.

(61.) If such a force act at one of the apses, either perihelion or aphelion, for a short time, it is clear that its effect will be represented by supposing that the velocity at that apse is suddenly increased, or that the velocity with which the planet is projected from perihelion is greater than the velocity with which it would have been projected if no disturbing force had acted. This will make no difference in the position of the line of apses; for with whatever velocity the planet is projected, if it is projected in a direction perpendicular to the radius vector, (which is implied in our supposition, that the place where the force acts was an apse in the old orbit,) the place of projection will infallibly be an apse in the new orbit; and the line of apses, which is the line drawn from that point through the sun, will be the same as before.

(62.) But if the force act for a short time before the planet reaches the perihelion, its principal* effect will be to increase its velocity; the sun's attraction will therefore have less power to curve its path (25.); the new orbit will be, in that part, exterior to the old one. In *fig.* 12, we

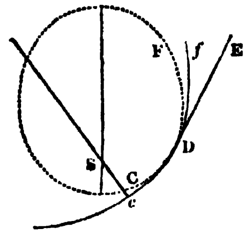
Fig. 12.



must therefore suppose that the planet, after leaving A, where the force has acted to accelerate its motion, instead of describing the orbit A C G, proceeds to describe the orbit A *c d*, which at A has the same direction (or has the same tangent A B) as the orbit A C G. It is plain now that *c* is the part nearest to the sun, or *c* is the perihelion: and it is evident here, that the line of apses has altered its position from S C to S *c*, or has twisted in a direction opposite to the angular motion of the planet, or has regressed.

(63.) If the force act for a short time after the planet has passed perihelion, as at D, in *fig.* 13, the planet's velocity is increased there, and the path described by the planet is D *f*, instead of D F, having the same direction at

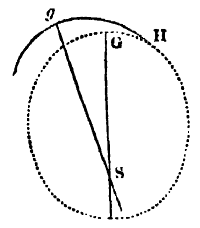
Fig. 13.



D, (or having the same tangent D E,) but less curved, and therefore exterior to D F. If now we conceive the planet to have received the actual velocity with which it is moving in D *f*, from moving without disturbance in an elliptic orbit *c* D *f*, (which is the orbit that it will now proceed to describe, if no disturbing force continues to act,) it is evident that the part *c* D must be described with a greater velocity than C D, inasmuch as the velocity at D from moving in *c* D is greater than the velocity from moving in C D; *c* D is therefore less curved than C D, and therefore exterior to it, (since it has the same direction at D); and then the perihelion is some point in the position of *c*, and the line of apses has changed its direction from S C to S *c*, or has twisted round in the same direction in which the planet is moving, or has progressed.

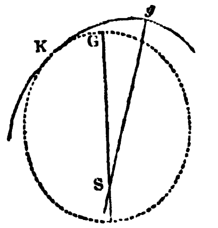
(64.) If the force act for a short time before passing the aphelion, it will be seen in the same manner that the line of apses is made to progress. It is only necessary to consider that (as before) the new orbit has the same direction at the point H, *fig.* 14, where the force has acted, as the old one,

Fig. 14.



but is less curved, and therefore exterior to it; and the aphelion, or point most distant from the sun, is *g* instead of G, and the position of the line of apses has shifted from S G to S *g*. If the force act after the planet has passed the aphelion, as at K, *fig.* 15, the orbit in which we must conceive the planet to have come, in order to have the increased

Fig. 15.



velocity, must be *g* K exterior to G K; the point most distant from the sun must be *g* instead of G, and the line of apses must have changed from S G to S *g*, or must have regressed.

(65.) Collecting these conclusions*, we see that, if a disturbing force act perpendicularly to the radius vector, in the direction in which the planet is moving, its action, while the planet passes from perihelion to aphelion, causes the line of apses to progress; and its action, while the planet passes from aphelion to perihelion, causes the apses to regress.

(66.) By similar reasoning, if the direction of the disturbing force is opposite to that in which the planet is moving, its action, while the planet passes from perihelion to aphelion, causes the line of apses to regress, and while

* It is supposed here, and in all our investigations, that the excentricity of the orbit is small, and, consequently, that a force perpendicular to the radius vector produces nearly the same effect as a force acting in the direction of a tangent to the ellipse.

* These conclusions, and those that follow, will be easily inferred from Newton's construction, Prop. XVII., by observing, that an increase of the velocity increases the length of P H in Newton's figure without altering its position.

the planet passes from aphelion to perihelion causes the apses to progress.

(67.) (XI.) For the effect on the excentricity: suppose the disturbing force, increasing the velocity, to act for a short time at perihelion; the effect is the same as if the planet were projected from perihelion with a greater velocity than that which would cause it to describe the old orbit. The sun's attraction therefore will not be able to pull it in into so small a compass as before; and at the opposite part of its orbit, that is, at aphelion, it will go off to a greater distance than before; but as it is moving without disturbance, and, therefore, in an ellipse, it will return to the same perihelion. The perihelion distance therefore remaining the same, and the aphelion distance being increased, the inequality of these distances is increased, and the orbit therefore is made more excentric. Now, suppose the force increasing the velocity to act at aphelion. Just as before, the sun's attraction will be unable to make the planet describe an orbit so small as its old orbit, and the distance at the opposite point (that is, at perihelion) will be increased; but the planet will return to the same aphelion distance as before. Here, then, the inequality of distances is diminished, and the excentricity is diminished.

(68.) Thus we see that a disturbing force, acting perpendicularly to the radius vector, in the direction of the planet's motion, increases the excentricity if it acts on the planet near perihelion, and diminishes the excentricity if it acts on the planet near aphelion. And, similarly, if the force acts in the direction opposite to that of the planet's motion, it diminishes the excentricity by acting near perihelion, and increases it by acting near aphelion.

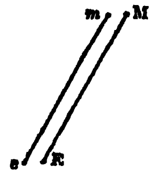
(69.) (XII.) In all these investigations, it is supposed that the disturbing force acts for a very short time, and then ceases. In future, we shall have to consider the effect of forces, which act for a long time, changing in intensity, but not ceasing. To estimate their effect we must suppose the long time divided into a great number of short times; we must then infer, from the preceding theorems, how the elements of the *instantaneous ellipse* (43.) are changed in each of these short times by the action of the force, which is then disturbing the motion; and we must then recollect, that the instantaneous ellipse, at the end of the long time under consideration, will be the same as the permanent ellipse in which the planet will move, if the disturbing force then ceases to act (43.), and that it will, at all events, differ very little from the curve described in the next revolution of the planet, even if the disturbing force continue to act. (41.)

SECTION IV.—*On the Nature of the Force disturbing a Planet or Satellite, produced by the Attraction of other Bodies.*

(70.) Having examined the effects of disturbing forces upon the elements of a planet's or satellite's orbit, we have now to inquire into the kind of the disturbing force which the attraction of another body produces. The inquiry is much simpler than might at first sight be expected; and this simplicity arises, in part, from the circumstance that (as we have mentioned in (6.)) the attraction of a planet upon the sun is the same as its attraction upon another planet, when the sun and the attracted planet are equally distant from the attracting planet.

(71.) First, then, we have to remark, that the disturbing force is not the whole attraction. The sun, for instance, attracts the moon, and disturbs its elliptic motion round the earth; yet the force which disturbs the moon's motion is not the whole attraction of the sun upon the moon. For the effect of the attraction is to move the moon from the place where it would otherwise have been; but the sun's attraction upon the earth also moves the earth from the place where it would otherwise have been; and if the alteration of the earth's place is exactly the same as the alteration of the moon's place, the relative situation of the earth and moon will be the same as before. Thus, if, in *fig.* 16, any attraction carries the earth from E to *e*, and carries the moon from M to *m*, and if E *e* is equal and parallel to M *m*, then *e m*, which is the distance of the earth and moon, on the supposition that the attraction acts on both, is equal to E M, which is their distance, on the supposition that the attraction acts on neither; and the line *e m*, which represents the direction in which the moon is seen from the earth,

Fig. 16.



if the attraction acts on both, is parallel to E M, which represents the direction in which the moon is seen from the earth, if the attraction acts on neither. The distance therefore of the earth and moon, and the direction in which the moon is seen from the earth, being unaltered by such a force, their relative situation is unaltered. An attraction, therefore, which acts equally, and in the same direction, on both bodies, does not disturb their relative motions.

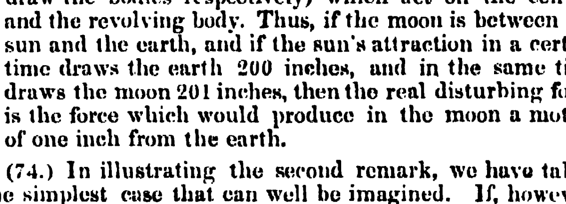
From this we draw the two following important conclusions:—

(72.) Firstly. A planet may revolve round the sun, carrying with it a satellite; and the satellite may revolve round the planet in nearly the same manner as if the planet was at rest. For the attraction of the sun on the planet is nearly the same as the attraction of the sun on the satellite. It is true that they are not exactly the same, and the effects of the difference will soon form an important subject of inquiry; but they are, upon the whole, very nearly the same. The moon is sometimes nearer to the sun than the earth is, and sometimes farther from the sun; and, therefore, the sun's attraction on the moon is sometimes greater than its attraction on the earth, and sometimes less; but, upon the whole, the inequality of attractions is very small. It is owing to this that we may consider a satellite as revolving round a planet in very nearly the same manner (in respect of relative motion) as if there existed no such body as the sun.

(73.) Secondly. The force which disturbs the motion of a satellite, or a planet, is the difference of the forces (measured, as in (4.), by the spaces through which the forces draw the bodies respectively) which act on the central and the revolving body. Thus, if the moon is between the sun and the earth, and if the sun's attraction in a certain time draws the earth 200 inches, and in the same time draws the moon 201 inches, then the real disturbing force is the force which would produce in the moon a motion of one inch from the earth.

(74.) In illustrating the second remark, we have taken the simplest case that can well be imagined. If, however, the moon is in any other situation with respect to the earth, some complication is introduced. Not only is the moon's distance from the sun different from the earth's distance, (which according to (9.) produces an inequality in the attractions upon the earth and moon,) but also the direction in which the attraction acts on the earth is different from the direction in which it acts on the moon, (inasmuch as the attraction always acts in the direction of the line drawn from the attracted body to the attracting body; and the lines so drawn from the earth and moon to the sun are in different directions). The same applies in every respect to the perturbation which one planet produces in the motion of a second planet round the sun, and which depends upon the difference in the first planet's attractions upon the sun and upon the second planet. To overcome this difficulty we must have recourse to geometrical considerations. In *fig.* 17, let B_1 be a body revolving about A, and let C be

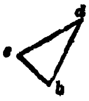
Fig. 17.



another body whose attraction disturbs the motion of B_1 round A. The attraction of C will in a certain time draw A to *a*; it will in the same time draw B_1 to b_1. Make $B_1\, d_1$ equal and parallel to A *a*; then *a* d_1 will be equal and parallel to A B_1. Now if the force upon B_1 were such as to draw it to d_1, the motion of B_1 round A would not be disturbed by that force. But the force upon B_1 is really such as to draw it to b_1. The real disturbing force then may be represented as a force which draws the revolving body from

d_1 to b_1. If, instead of supposing the revolving body to be at B_1 we suppose it at B_2, and if the attraction of C would draw it through $B_2\,b_2$ while it draws A through A a, then (in the same manner, making $B_2\,d_2$ equal and parallel to A a) the real disturbing force may be represented by a force which in the same time would draw B_2 through $d_2\,b_2$.

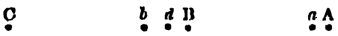
(75.) Both the magnitude and the direction of this force are continually varying, and we must, if possible, find a convenient way of representing it. We shall have recourse

Fig. 18. 

here to the 'composition of motion.' In *fig.* 18, if $d\,b$ represent the space through which a force has drawn a body in a certain time, the same effect may be produced by two forces of which one would in the same time draw the body from d to e, and the other would in the same time draw the body from e to b. And this is true whatever be the directions and lengths of $d\,e$ and $e\,b$, provided that with $d\,b$ they form a triangle. To accommodate the investigations of this Section to those of Section III., we will suppose $d\,e$ perpendicular to the radius vector, and $e\,b$ parallel to the radius vector. In *fig.* 17, draw $d\,e$ perpendicular to A B or $a\,d$, and $e\,b$ parallel to A B or $a\,d$; and now we can say: the disturbing force produced by the attraction of C is a force represented by $d\,e$ perpendicular to the radius vector, and a force represented by $e\,b$ in the direction of the radius vector.

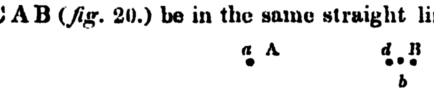
(76.) We now want nothing but estimations of the magnitudes of these forces in order to apply the investigations of Section III. For the present we shall content ourselves with pointing out some of the most interesting cases.

(77.) I. Let the disturbing body be exterior to the orbit of the disturbed body: (this applies to the disturbance of the moon's motion produced by the sun's attraction, the disturbance of the earth's motion by Jupiter's attraction, the disturbance of the motion of Venus by the earth's

Fig. 19. 

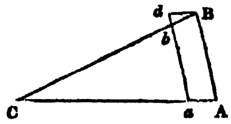
attraction, &c.:) and first, let the revolving body B be between the disturbing body C and the central body A (as in *fig.* 19.). If the attraction of C will in a certain time draw A to a, it will in the same time draw B to b, where B b is much greater than A a. Take B d equal to A a, then $d\,b$ is the effect of the disturbing force, which tends to draw B further from A. In this case then, the disturbing force is entirely in the direction of the radius vector, and directed *from* the central body. This is the greatest disturbing force that can be produced by C.

(78.) II. Let C A B (*fig.* 20.) be in the same straight line,

Fig. 20. 

but let B be on the side of A, opposite to C. In this case B b is less than A a; and if B d is taken equal to A a, the disturbing force represented by $d\,b$ will be entirely in the direction of the radius vector, and directed from the central body. This case is particularly deserving of the reader's consideration, as the *effectual disturbing* force is exactly opposite to the attraction which C actually exerts upon B.

(79.) III. The disturbing force in the case represented in *fig.* 19, is much greater than that in the case of *fig.* 20, except C be very distant. Thus, suppose A B to be half of A C. In the first case, the attraction upon B (by the law of gravitation) is four times as great as the attraction upon A, and therefore the disturbing force (which is the difference of the forces on A and B) is three times as great as the attraction upon A. In the second case, the distance of B is $\frac{3}{2}$ of the distance of A, and therefore the attraction upon B is $\frac{4}{9}$ of the attraction upon A, and the disturbing force is $\frac{5}{9}$ of the attraction upon A. The disturbing force in the first case is, therefore, greater than in the second case, in the proportion of 3 to $\frac{5}{9}$, or 27 to 5. This remark applies to nearly all the cases of planetary disturbance where the disturbing planet is exterior to the orbit of the disturbed planet, the ratio between these distances from the sun being a ratio of not very great inequality. But it scarcely applies to the moon. For the sun's distance from the earth is nearly 400 times the moon's distance: consequently when the moon is between the sun and the earth, the attraction of the sun on the moon is $(\frac{400}{399})^2\times$ the attraction of the sun on the earth, or $\frac{160000}{159201}$ parts of the sun's attraction on the earth, and the disturbing force therefore is $\frac{799}{159201}$ parts of the sun's attraction on the earth: but when the moon is on that side farthest from the sun, the sun's attraction on the moon is $(\frac{400}{401})^2$ or $\frac{160000}{160801}$ parts of the sun's attraction on the earth, and the disturbing force is $\frac{801}{160801}$ parts of the sun's attraction on the earth, which is very little less than the former The effects of the difference are, however, sensible.

Fig. 21. 

(80.) IV. Suppose B, *fig.* 21, to be in that part of its orbit which is at the same distance from C as the distance of A from C. The attraction of C upon the two other bodies, whose distances are equal, will be equal, but not in the same direction. B b, therefore, will be equal to A a. But since C B is also equal to C A, it is evident that $a\,b$ will be parallel to A B, and therefore b will be in the line $a\,d$. Consequently in this case also the disturbing force will be entirely in the direction of the radius vector: but here, unlike the other cases, the disturbing force is directed *towards* the central body. The magnitude of the disturbing force bears the same proportion to the whole attraction on A which $b\,d$ bears to B b, or A B to A C. Thus, in the first numerical instance taken above, the disturbing force in this part of the orbit is $\frac{1}{2}$ of the attraction on A: and in the second numerical instance, the disturbing force is $\frac{1}{400}$ of the attraction on A. It is important to observe that in both instances the disturbing force, when wholly directed *to* the centre, is much less than either value of the disturbing force when wholly directed *from* the centre: in the latter instance it is almost exactly one-half.

(81.) When the disturbing body is distant, the point of the orbit which we have here considered is very nearly that determined by drawing A B perpendicular to C A.

(82.) V. When C is distant, (as in the case of the moon disturbed by the sun,) the disturbing forces mentioned in (III.) and (IV.) are nearly proportional to the distance of the moon from the earth. For the force mentioned in (IV.) this is exactly true, whether C be near or distant, because (as we have found) the disturbing force bears the same proportion to the whole attraction on A which A B bears to A C. With regard to the force mentioned in (III.); if we suppose the moon's distance from

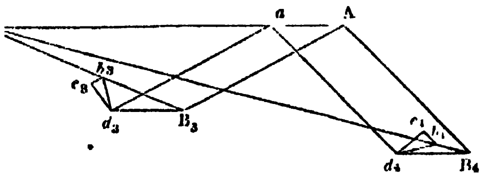
force when the moon is between the earth and the sun is $\frac{799}{159201}$ parts of the sun's attraction on the earth, or nearly $\frac{1}{200}$th part. But if we suppose the moon's distance from the earth to be $\frac{1}{200}$th of the sun's distance, the attraction on the moon (when between the earth and the sun) would be $(\frac{200}{199})^2$ or $\frac{40000}{39601}$ parts of the attraction on the earth; the disturbing force, or the difference of attractions on the earth and moon, would be $\frac{399}{39601}$, or nearly $\frac{1}{100}$th part of the sun's attraction on the earth. Thus, on doubling the moon's distance from the earth, the disturbing force is nearly doubled: and in the same manner, on altering the distance in any other proportion, we should find that the disturbing force is altered in nearly the same proportion.

(83.) VI. If, while the moon's distance from the earth is not sensibly altered, the earth's distance from the sun is altered, the disturbing force is diminished very nearly in the same ratio in which the cube of the sun's distance is increased. For if the sun's distance is 400 times the moon's distance, and the moon between the earth and the sun, we have seen that the disturbing force is nearly $\frac{1}{200}$th part of the sun's attraction on the earth *at that distance of the sun*. Now, suppose the sun's distance from the earth to be made 800 times the moon's distance, or twice the former distance: the sun's distance from the moon will be 799 times the moon's distance, or $\frac{799}{400}$ parts of the sun's former distance from the earth; the attractions on the earth and moon respectively will be $\frac{1}{4}$ and $\frac{160000}{638401}$ parts of the former attraction on the earth: and the

disturbing force, or the difference between these, will be $\frac{1599}{[illegible]}$, or nearly $\frac{1}{1600}$th part of the former attraction of the earth. Thus, on doubling the sun's distance, the disturbing force is diminished to $\frac{1}{8}$ part of its former value; and a similar proposition would be found to be true if the sun's distance were altered in any other proportion.

(84.) VII. Suppose B to have moved from that part of its orbit where its distance from C is equal to A's distance from C, towards the part where it is between A and C. Since at the point where B's distance from C is equal to A's distance from C, the disturbing force is in the direction of the radius vector, and directed *towards* A, and since at the point where B is between A and C, the disturbing force is in the direction of the radius vector, but directed *from* A, it is plain that there is some situation of B, between these two points, in which there is no disturbing force at all in the direction of the radius vector. On this we shall not at present speak further: but we shall remark that there is a disturbing force perpendicular to the radius vector, at every such intermediate point. This will be easily seen from the second case of *fig.* 17. On going through the reasoning in that place it will appear that, between the two points that we have mentioned, there is always a disturbing force $d_2 e_2$ perpendicular to the radius vector, and in the same direction in which the body is going. If now we construct a similar figure for the situation B_3, *fig.* 22, in which B is moving

Fig. 22.

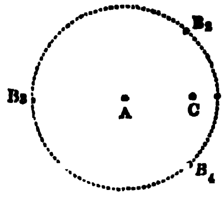


from the point between C and A to the other point whose distance from C is equal to A's distance from C, we shall find that there is a disturbing force $d_3 e_3$ perpendicular to the radius vector, in the direction opposite to that in which B is going. If we construct a figure for the situation B_4, in which B is moving from the point of equal distances to the point where B is on the side of A opposite to C, we shall see that there is a disturbing force perpendicular to the radius vector, in the same direction in which B is going; and in the same manner, for the situation B_1 in *fig.* 17, where B is moving from the point on the side of A opposite C to the next point of equal distances, there is a disturbing force perpendicular to the radius vector, in the direction opposite to that in which B is going.

(85.) The results of all these cases may be collected thus. The disturbing body being exterior to the orbit of the revolving body, there is a disturbing force in the direction of the radius vector only, directed *from* the central body, at the points where the revolving body is on the same side of the central body as the disturbing body, or on the opposite side, (the force in the former case being the greater,) and directed *to* the central body, at each of the places where the distance from the disturbing body is equal to the distance of the central body from the disturbing body. The force directed to the central body at the latter points, is however much less than the force directed from it at the former. Between the adjacent pairs of these four points there are four other points, at which the disturbing force in the direction of the radius vector is nothing. But while the revolving body is moving from one of the points, where it is on the same side of the central body as the disturbing body, or on the opposite side, to one of the equidistant points, there is always a disturbing force perpendicular to the radius vector tending to retard it; and while it is moving from one of the equidistant points to one of the points on the same side of the central body as the disturbing body, or the opposite, there is a disturbing force perpendicular to the radius vector tending to accelerate it.

(86.) VIII. Now, let the disturbing body be supposed interior to the orbit of the revolving body, (as, for instance, when Venus disturbs the motion of the earth). If B is in the situation B_1, *fig.* 23, the attraction of C draws A strongly towards B_1, and B_1 strongly towards A, and, therefore, there is a very powerful disturbing force drawing B_1 towards A. If B is in the situation B_3, the attraction of C draws A strongly from B_3, and draws B_3 feebly

Fig. 23.



towards A; therefore, there is a small disturbing force drawing B_3 from A. At some intermediate points the disturbing force in the direction of the radius vector is nothing. With regard to the disturbing force perpendicular to the radius vector: if A C is greater than $\frac{1}{2}$ A B_1, it will be possible to find two points, B_2 and B_4, whose distance from C is equal to the distance of A from C, and there the disturbing force perpendicular to the radius vector is nothing (or the whole disturbing force is in the direction of the radius vector). While B moves from the position B_1 to B_2, it will be seen by such reasoning as that of (75.) and (84.), that the disturbing force, perpendicular to the radius vector, retards B's motion; while B moves from B_2 to B_3, it accelerates B's motion; while B moves from B_3 to B_4 it retards B's motion; and while B moves from B_4 to B_1, it accelerates B's motion. But if A C is less than $\frac{1}{2}$ A B_1, there are no such points, B_2 B_4, as we have spoken of; and the disturbing force, perpendicular to the radius vector, accelerates B as it moves from B_1 to B_3, and retards B as it moves from B_3 to B_1.

We shall now proceed to apply these general principles to particular cases.

Section V.—*Lunar Theory.*

(87.) The distinguishing feature in the Lunar Theory is the general simplicity occasioned by the great distance of the disturbing body (the sun alone producing any sensible disturbance), in proportion to the moon's distance from the earth. The magnitude of the disturbing body renders these disturbances very much more conspicuous than any others in the solar system; and, on this account, as well as for the accuracy with which they can be observed, these disturbances have, since the invention of the Theory of Gravitation, been considered the best tests of the truth of the theory.

Some of the disturbances are independent of the excentricity of the moon's orbit; others depend, in a very remarkable manner, upon the excentricity. We shall commence with the former.

(88.) The general nature of the disturbing force on the moon may be thus stated. (See (77.) to (86.).) When the moon is either at the point between the earth and sun, or at that opposite to the sun (both which points are called syzygies), the force is entirely in the direction of the radius vector, and directed from the earth. When the moon is (very nearly) in the situations at which the radius vector is perpendicular to the line joining the earth and sun (both which points are called quadratures), the force is entirely in the direction of the radius vector, and directed to the earth. At certain intermediate points there is no disturbing force in the direction of the radius vector. Except at syzygies and quadratures, there is always a force perpendicular to the radius vector, such as to retard the moon while she goes from syzygy to quadrature, and to accelerate her while she goes from quadrature to syzygy.

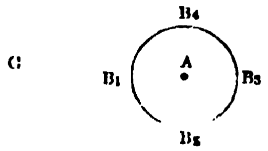
(89.) I. As the disturbing force, in the direction of the radius vector, directed from the earth, is greater than that directed to the earth, we may consider that, upon the whole, the effect of the disturbing force is to diminish the earth's attraction. Thus the moon's mean distance from the earth is less (see (46.)) than it would have been with the same periodic time, if the sun had not disturbed it. The force perpendicular to the radius vector sometimes accelerates the moon, and sometimes retards it, and, therefore, produces no permanent effect.

(90.) II. But the sun's distance from the earth is subject to alteration, because the earth revolves in an elliptic orbit round the sun. Now, we have seen (83.) that the magnitude of the disturbing force is inversely proportional to the cube of the sun's distance; and, consequently, it is sensibly greater when the earth is at perihelion than when at aphelion. Therefore, while the earth moves from perihelion to aphelion, the disturbing force is con-

tinually diminishing; and while it moves from aphelion to perihelion, the disturbing force is constantly increasing. Referring then to (47.) it will be seen, that in the former of these times the moon's orbit is gradually diminishing, and that in the latter it is gradually enlarging. And though this alteration is not great (the whole variation of dimensions, from greatest to least, being less than $\frac{1}{1000}$, the effect on the angular motion (see (49.)) is very considerable; the angular velocity becoming quicker in the former time and slower in the latter; so that while the earth moves from perihelion to aphelion, the moon's angular motion is constantly becoming quicker, and while the earth moves from aphelion to perihelion the moon's angular motion is constantly becoming slower. Now, if the moon's mean motion is determined by comparing two places observed at the interval of many years, the angular motion so found is a mean between the greatest and least. Therefore, when the earth is at perihelion, the moon's angular motion is slower than its mean motion; and when the earth is at aphelion, the moon's angular motion is quicker than its mean motion. Consequently, while the earth is going from perihelion to aphelion, the moon's true place is always behind its mean place (as during the first half of that period the moon's true place is dropping behind the mean place, and during the latter half is gaining again the quantity which it had dropped behind); and while the earth is going from aphelion to perihelion, the moon's true place is always before its mean place. This inequality is called the moon's *annual equation;* it was discovered by Tycho Brahé from observation, about A.D. 1590; and its greatest value is about 10′, by which the true place is sometimes before and sometimes behind the mean place.

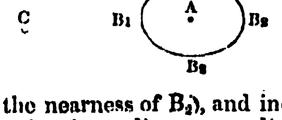
(91.) III. The disturbances which are periodical in every revolution of the moon, and are independent of excentricity, may thus be investigated. Suppose the sun to stand still for a few revolutions of the moon (or rather suppose the earth to be stationary,) and let us inquire in what kind of orbit, symmetrical on opposite sides, the sun can move. It cannot move in a circle: for the force perpendicular to the radius vector retards the moon as it goes from B_1 to B_2, *fig.* 24, and its velocity is therefore less at B_2 than at B_1, and on this account (supposing the

Fig. 24.



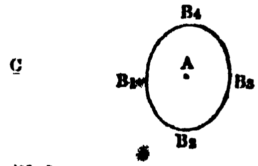
force directed to A at B_2 equal to the force directed to A at B_1,) the orbit would be more curved at B_2 than at B_1. But the force directed to A at B_2 is much greater than at B_1 (see (88.)); and on this account the orbit would be still more curved at B_2 than at B_1; whereas, in a circle, the curvature is everywhere the same. The orbit cannot therefore be circular. Neither can it be an oval with the earth in its centre, and with its longer axis passing through the sun, as *fig.* 25; for the velocity being small at B_2 (in consequence of the disturbing force perpendicular to the radius vector having retarded it) while the earth's attraction is great (in con-

Fig. 25.



sequence of the nearness of B_2), and increased by the disturbing force in the radius vector directed towards the earth, the curvature at B_2 ought to be much greater than at B_1, where the velocity is great, the moon far off, and the disturbing force directed from the earth. But, on the contrary, the curvature at B_2 is much less than at B_1; therefore, this form of orbit is not the true one. But if the orbit be supposed to be oval, with its shorter axis directed towards the sun, as in *fig.* 26, all the conditions will be satisfied. For the velocity at B_2 is diminished by the disturbing force having acted perpendicularly to the radius vector, while the moon goes from B_1 to B_2; and though, the distance from A being greater, the earth's attraction at B_2 will be less than the attraction at B_1; yet, when increased by the disturbing force, directed to

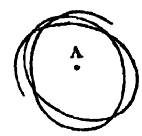
Fig. 26.



A at B_2, it will be very little less than the attraction diminished by the disturbing force at B_1. The diminution of velocity then at B_2 being considerable, and the diminution of force small, the curvature will be increased; and this increase of curvature, by proper choice of the proportions of the oval, may be precisely such as corresponds to the real difference of curvature in the different parts of the oval. Hence, such an oval may be described by the moon without alteration in successive revolutions.

(92.) We have here supposed the earth to be *stationary* with respect to the sun. If however we take the true case of the earth moving round the sun, or the sun appearing to move round the earth, we have only to suppose that the oval twists round after the sun, and the same reasoning applies. The curve described by the moon is then such as is represented in *fig.* 27. As the disturbing force, perpen-

Fig. 27.



dicular to the radius vector, acts in the same direction for a longer time than in the former case, the difference in the velocity at syzygies and at quadratures is greater than in the former case, and this will require the oval to differ from a circle, rather more than if the sun be supposed to stand still.

(93.) If, now, in such an orbit as we have mentioned, the law of *uniform description of areas by the radius vector* were followed, as it would be if there were no force perpendicular to the radius vector, the angular motion of the moon near B_2 and B_4, *fig.* 26, would be much less than that near B_1 and B_3. But in consequence of the disturbing force, perpendicular to the radius vector, (which retards the moon from B_1 to B_2, and from B_3 to B_4, and accelerates it from B_2 to B_3, and from B_4 to B_1,) the angular motion is still less at B_2 and B_4, and still greater at B_1 and B_3. The angular motion therefore diminishes considerably while the moon moves from B_1 to B^2, and increases considerably while it moves from B_2 to B_3, &c. The mean angular motion, determined by observation, is less than the former and greater than the latter. Consequently, the angular motion at B_1 is greater than the mean, and that at B_2 is less than the mean; and therefore, (as in (90.),) from B_1 to B_2 the moon's true place is before the mean; from B_2 to B_3 the true place is behind the mean; from B_3 to B_4 the true place is before the mean; and from B_4 to B_1 the true place is behind the mean. This inequality is called the moon's *variation;* it amounts to about 32′, by which the moon's true place is sometimes before and sometimes behind the mean place. It was discovered by Tycho Brahé, from observation about A.D. 1590.

(94.) We have however mentioned, in (79.), that the disturbing forces are not exactly equal on the side of the orbit which is next the sun, and on that which is farthest from the sun; the former being rather greater. To take account of the effects of this difference, let us suppose, that in the investigation just finished, we use a mean value of the disturbing force. Then we must, to represent the real case, suppose the disturbing force near conjunction to be increased, and that near opposition to be diminished. Observing what the nature of these forces is, (77.), (78.), and (84.), this amounts to supposing that near conjunction the force necessary to make up the difference is a force acting in the radius vector, and directed from the earth, and a force perpendicular to the radius vector, accelerating the moon before conjunction, and retarding her after it, and that near opposition the forces are exactly of the contrary kind. Let us then lay aside the consideration of all other disturbing forces, and consider the inequality which these forces alone will produce. As they are very small, they will not in one revolution alter the orbit sensibly from an elliptic form. What then must be the excentricity, and what the

position of the line of apses that, with these disturbing forces only, the same kind of orbit may always be described? A very little consideration of (57.), (58.), and (68.), will show, that unless the line of apses pass through the sun, the excentricity will either be increasing or diminishing from the action of these forces. We must assume therefore, as our orbit is to have the same excentricity at each revolution, that the line of apses passes through the sun. But is the perigee or the apogee to be turned towards the sun? To answer this question we have only to observe, that the lines of apses must progress as fast as the sun appears to progress, and we must therefore choose that position in which the forces will cause progression of the line of apses. If the perigee be directed to the sun, then the forces at both parts of the orbit will, by (51.), (54.), (65.), and (66.), cause the line of apses to regress. This supposition, then, cannot be admitted. But if the apogee be directed to the sun, the forces at both parts of the orbit will cause it to progress; and by (56.), if a proper value is given to the excentricity it will progress exactly as fast as the sun appears to progress. The effect, then, of the difference of forces of which we have spoken, is to elongate the orbit towards the sun, and to compress it on the opposite side. This irregularity is called the *parallactic inequality*.

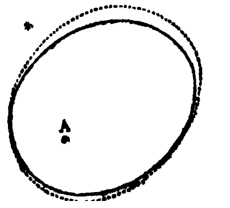
We shall shortly show, that if the moon revolved in such an elliptic orbit as we have mentioned, the effect of the other disturbing forces (independent of that discussed here) would be to make its line of apses progress with a considerable velocity. The force considered here, therefore, will merely have to cause a progression which, added to that just mentioned, will equal the sun's apparent motion round the earth. The excentricity of the ellipse, in which it could produce this smaller motion, will (56.) be greater than that of the ellipse in which the same force could produce the whole motion. Thus the magnitude of the parallactic inequality is considerably increased by the indirect effect of the other disturbing forces.

(95.) The magnitude of the forces concerned here is about $\frac{1}{130}$th of those concerned in (91.), &c.; but the effect is about $\frac{1}{15}$th of their effect. This is a striking instance of the difference of proportions, in forces and the effects that they produce, depending on the difference in their modes of action. The inequality here discussed is a very interesting one, from the circumstance that it enables us to determine with considerable accuracy the proportion of the sun's distance to the moon's distance, which none of the others will do, as it is found upon calculation that their magnitude depends upon nothing but the excentricities and the proportion of the periodic times, all which are known without knowing the proportion of distances.

(96.) The effect of this, it will be readily understood, is to be combined with that already found. *See the Note to (134.).* The moon's orbit therefore is more flattened on the side farthest from the sun, and less flattened on the side next the sun, than we found in (91.) and (92.). The equable description of areas is scarcely affected by these forces. The moon's *variation* therefore is somewhat diminished near conjunction, and is somewhat increased near opposition.

(97.) It will easily be imagined, that if there is an excentricity in the moon's orbit, the effect of the *variation* upon that orbit will be almost exactly the same as if there were no excentricity.* Thus, supposing that the orbit without the disturbing force had such a form as the dark line in *fig.* 28, it will, with the disturbing force, have such a form as

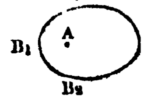
Fig. 28.



the dotted line in that figure. The same must be understood in many other cases of different inequalities which affect the motion of the same body.

(98.) IV. We now proceed with the disturbances dependent on the excentricity: and first with the motion of the moon's perigee. In the first place, suppose that the perigee is on the same side as the sun. While the moon is near B_1, *fig.* 31, that is, near perigee, the disturbing force is directed from A; and consequently by (51.) the line of apses regresses. While the moon is near B_3, that is,

Fig. 31.

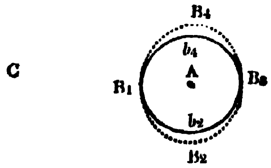


near apogee, the disturbing force is also directed from A, and consequently by (54.) the line of apses progresses. The question then now is, which is the greater, the regress, when the moon is near B_1, or the progress, when it is near B_3? To answer this we will remark, that if the disturbing force directed from A were inversely proportional to the square of the distance (and consequently less at B_3 than at B_1), it would amount to exactly the same as if the attraction of A were altered in a given proportion;* and in that case B would describe round A an ellipse, whose line of apses was invariable; or the progression produced at B_3 would be equal to the regression produced at B_1. But in fact the disturbing force at B_3 is to that at B_1 in the same proportion as A B_3 to A B_1, by (82.); and therefore the disturbing force at B_3 is greater than that at B_1, and consequently much greater than that which would produce a progression equal to the regression produced at B_1; and therefore the effects of the disturbing force at B_3 predominate, and the line of apses progresses. The disturbing force directed to A in the neighbourhood of B_2 and B_4 scarcely produces any effect, as on one side of each of those points the effect is of one kind, and on the other side it is of the opposite kind (55.).

(99.) The disturbing force directed from A, though the

* As this general proposition is of considerable importance, we shall point out the nature of the reasoning by which (with proper alteration for different cases), the reader may satisfy himself of its correctness. The reason why, in *fig.* 29, the moon cannot describe the circle B_1, b_2, B_3, b_4, though it touches at B_1 and B_3, and the reason that it will describe the oval B_1, B_2, B_3, B_4, is,

Fig. 29.



that the disturbing force makes the forces at B_1 and B_3 less than they would otherwise have been, and greater at B_2 and B_4 than they would otherwise have been; and the velocity is, by that part of the force perpendicular to the radius vector, made less at B_2 than it would otherwise have been. So that, unless we supposed it moving at B_1 with a greater velocity than it would have had undisturbed in the circle B_1, b_2, B_3, b_4, the great curvature produced by the great force and diminished velocity at B_2 would have brought it much nearer to A than the point B_3; but with this large velocity at B_1, it will go out farther at B_2, and then the great curvature may make it pass exactly through B_3. In like manner, in *fig.* 30, if the velocity at B_1 were not greater than it would have had undisturbed in the ellipse B_1, b_2, B_3, b_4, the increased curvature at B_2, produced by the increased force and diminished velocity there, would

Fig. 30.

have brought it much nearer to A than the point B_3; but with a large velocity at B_1 it will go out at B_2 further than it would otherwise have gone out, and then the increased force and diminished velocity will curve its course so much, that it may touch the elliptic orbit at B_3; and so on. The whole explanation, in one case as much as in the other, depends entirely upon the difference of the forces in the actual case, from the forces, if the moon were not disturbed.

* The reasoning in the text may be more fully stated thus: If, with the original attractive force of the earth there be combined another force, directed from the earth, and always bearing the same proportion to the earth's original attraction, this combined force may be considered in two ways: 1st, As a smaller attraction, always proportional to the original attraction, or inversely proportional to the square of the distance. 2nd, As the original attraction, with a force superadded, which may be treated as a disturbing force. The result of the first mode of consideration will be, that the moon will describe an ellipse, whose line of apses does not move. The result of the second mode of consideration will be, that the instantaneous ellipse (in which the moon would proceed to move, if the additional force should cease) will have its line of apses regressing, while the moon is near perigee, and progressing while she is near apogee. There is however no incongruity between the immobility of the line of apses in the first mode of consideration, and the progress or regress in the second; because the line of apses of the instantaneous ellipse in the second case is an imaginary line, determined by supposing the disturbing force to cease, and the moon to move undisturbed. At the apses however the line of apses must be the same in both methods of consideration; since, whether the disturbing force cease or not, the perpendicularity of the direction of the motion to the radius vector determines the place of an apse. Consequently, while the moon moves from one apse to the other, the motions of the line of apses in the second mode of consideration must be such as to produce the same effect on the position of the line of apses as in the first mode of consideration; that is, they must not have altered its place; and hence the progression at one time must be exactly equal to the regression at the other time.

only one at B_1 and B_3, is not however the only one in the neighbourhood of B_1 and B_3. While the moon is approaching to B_1, the force perpendicular to the radius vector accelerates the moon, and therefore, by (65.), as B_1 is the place of perigee, the line of apses regresses: when the moon has passed B_1, the force retards the moon, and therefore, by (66.), the line of apses still regresses. But when the moon is approaching B_3, the force perpendicular to the radius vector accelerates the moon; and therefore, by (65.) and (66.), as B_3 is the place of apogee, the line of apses progresses; when the moon has passed B_3, the force retards the moon, and the line of apses still progresses. The question now is, whether the progression produced by the force perpendicular to the radius vector near B_3 will or will not exceed the regression produced near B_1? To answer this we must observe, that the rate of this progress or regress depends entirely upon the proportion* which the velocity produced by the disturbing force bears to the velocity of the moon; and since from B_2 to B_3, and from B_3 to B_4, the disturbing force is greater than that from B_4 to B_1, and from B_1 to B_2, and acts for a longer time (as by the law of equable description of areas, the moon is longer moving from B_2 to B_3 and B_4 than from B_4 to B_1 and B_2), and since the moon's velocity in passing through B_2, B_3, B_4, is less than her velocity in passing through B_4, B_1, B_2, it follows that the effect in passing through B_2, B_3, B_4, is much greater than that in passing through B_4, B_1, and B_2. Consequently, the effect of this force also is to make the line of apses progress.

(100.) On the whole therefore, when the perigee is turned towards the sun, the line of apses progresses rapidly. And the same reasoning applies in every respect when the perigee is turned from the sun.

(101.) In the second place, suppose that the line of apses is perpendicular to the line joining the earth and sun. The disturbing force at both apses is now directed to the earth, and consequently, by (50.) and (53.), while the moon is near perigee, the disturbing force causes the line of apses to progress, and while the moon is near apogee the disturbing force causes the line of apses to regress. Here, as in the last article, the effects at perigee and at apogee would balance if the disturbing force were inversely proportional to the square of the distance from the earth. But the disturbing force is really proportional to the distance from the earth; and therefore, as in (98.), the effect of the disturbing force, while the moon is at apogee, preponderates over the other; and therefore the force directed to the centre causes the line of apses to regress.

(102.) We must also consider the force perpendicular to the radius vector. In this instance, that force retards the moon while she is approaching to each apse, and accelerates her as she recedes from it. The effect is, that when the moon is near perigee the force causes the line of apses to progress, and when near apogee it causes the line of apses to regress. (65.) and (66.) The latter is found to preponderate, by the same reasoning as that in (99.). From the effect, then, of both causes, the line of apses regresses rapidly in this position of the line of apses.

(103.) It is important to observe here, that the motion of the line of apses would not, as in (56.), be greater if the excentricity of the orbit were smaller. For though the motion of the line of apses is greater *in proportion to the force which causes it* when the excentricity is smaller; yet, in the present instance, the force which causes it is itself proportional to the excentricity (inasmuch as it is the difference of the forces at perigee and apogee, which would be equal if there were no excentricity): so that if the excentricity were made less, the force which causes the motion of the line of apses would also be made less, and the motion of the line of apses would be nearly the same as before.

(104.) It appears then, that when the line of apses passes through the sun, the disturbing force causes that line to progress; when the earth has moved round the sun, or the sun has appeared to move round the earth, so far that the line of apses is perpendicular to the line joining the sun and the earth, the line of apses regresses from the effect of the disturbing force; and at some intermediate position, it may easily be imagined that the force produces no effect on it. It becomes now a matter of great interest to inquire, whether upon the whole the progression exceeds the regression. Now the force perpendicular to the radius vector, considered in (99.), is almost exactly equal to that considered in (102.); so that the progression produced by that force when the line of apses passes through the sun, is almost exactly equal to the regression which it produces when the line of apses is perpendicular to the line joining the earth and sun; and this force may therefore be considered as producing no effect (except indirectly, as will be hereafter mentioned). But the force in the direction of the radius vector, tending from the earth in (98.), is, as we have mentioned in (80.), almost exactly double of that tending to the earth in (101.), and therefore its effect predominates: and therefore, on the whole, the line of apses progresses. In fact, the progress, when the line of apses passes through the sun, is about 11° in each revolution of the moon; the regress, when the line of apses is perpendicular to the line joining the earth and sun, is about 9° in each revolution of the moon.

(105.) The progression of the line of apses of the moon is considerably greater than the first consideration would lead us to think, for the following reasons.

(106.) Firstly. The earth is revolving round the sun, or the sun appears to move round the earth, in the same direction in which the moon is going. This lengthens the time for which the sun acts in any one manner upon the moon, but it lengthens it more for the time in which the moon is moving slowly, than for that in which it is moving quickly. Thus, suppose that the moon's angular motion when she is near perigee is fourteen times the sun's angular motion: and when near apogee, only ten times the sun's motion. Then she passes the sun at the former time, (as seen from the earth,) with $\frac{13}{14}$ths of her whole motion, but at the latter with only $\frac{9}{10}$ths; consequently, when near perigee, the time in which the moon passes through a given angle from the moving line of syzygies, (or the time in which the angle between the sun and moon increases by a given quantity,) is $\frac{14}{13}$ths of the time in which it would have passed through the same angle, had the sun been stationary; when near apogee, the number expressing the proportion is $\frac{10}{9}$ths. The latter number is greater than the former; and, therefore, the effect of the forces acting near apogee is increased in a greater proportion than that of the forces acting near perigee. And as the effective motion of the line of apses is produced by the excess of the apogeal effect above the perigeal effect, a very small addition to the former will bear a considerable proportion to the effective motion previously found; and thus the effective motion will be sensibly increased.

(107.) Secondly. When the line of apses is directed toward the sun, the whole effect of the force is to make it progress, that is, to move in the same direction as the sun: the sun passes through about 27° in one revolution of the moon, and, therefore, departs only 16° from the line of apses; and therefore the apse continues a long time near the sun. When at right angles to the line joining the earth and sun, the whole effect of the force is to make it regress, and therefore, moving in the direction opposite to the sun's motion, the angle between the sun and the line of apses is increased by 36° in each revolution, and the line of apses soon escapes from this position. The effect of the former force is therefore increased, while that of the latter is diminished: and the preponderance of the former is much increased. It is in increasing the rapidity of progress at one time, and the rapidity of regress at another, that the force perpendicular to the radius vector

* Suppose, for facility of conception, that the force perpendicular to the radius vector acts in only one place in each quadrant between syzygies and quadratures. The portions of the orbit which are bisected by the line of syzygies will be described with greater velocity in consequence of this disturbance (abstracting all other causes) than the other portions. Now the curvature of any part of an orbit does not depend on the central force simply, or on the velocity, but on the relation between them; so that the same curve may be described either by leaving the central force unaltered and increasing the velocity in a given proportion, or by diminishing the central force in a corresponding proportion, and leaving the velocity unaltered. Consequently, in the case before us, the same curve will be described as if, without alteration of velocity, the central force were diminished, while the moon passed through the portions bisected by the line of syzygies. If now the imaginary diminution of central force were in the same proportion (that is, if the real increase of velocity were in the same proportion) at both syzygies, which here coincide with the apses, the regression of the line of apses produced at perigee would be equal to the progression produced at apogee. But the increase of velocity produced by the force perpendicular to the radius vector near apogee is much greater than that near perigee. First, because the force is greater in proportion to the distance. Second, because the time of describing a given small angle is greater in proportion to the square of the distance; so that the acceleration produced while the moon passes through a given angle is proportional to the cube of the distance. Third, because the velocity, which is increased by this acceleration, is inversely proportional to the distance; so that the ratio in which the velocity is increased is proportional to the fourth power of the distance. The effect at the greater distance therefore predominates over that at the smaller distance; and therefore, on the whole, the force perpendicular to the radius vector produces an effect similar to its apogeal effect; that is, it causes the line of apses to progress.

indirectly increases the effect of the former in the manner just described.

(108.) From the combined effect of these two causes, the actual progression of the line of apses is nearly double of what it would have been if, in different revolutions of the moon, different parts of its orbit had been equally subjected to the disturbing force of the sun.

(109.) The line of apses upon the whole, therefore, progresses; and (as calculation and observation agree in showing) with an angular velocity that makes it (on the average) describe 3° in each revolution of the moon, and that carries it completely round in nearly nine years. But as it sometimes progresses and sometimes regresses for several months together, its motion is extremely irregular. The general motion of the line of apses has been known from the earliest ages of astronomy.

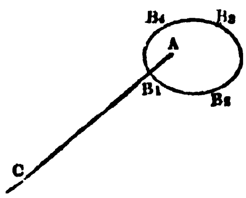
(110.) V. For the alteration of the excentricity of the moon's orbit: first, let us consider the orbit in the position in which the line of apses passes through the sun, *fig.* 31. While the moon moves from B_1 (the perigee,) to B_2, (the apogee,) the force in the direction of the radius vector is sometimes directed to the earth, and sometimes from the earth, and therefore, by (57.) and (59.), it sometimes diminishes the excentricity and sometimes increases it. But while the moon moves from B_2 to B_1, there are exactly equal forces acting in the same manner at corresponding parts of the half-orbit, and these, by (58.), will produce effects exactly opposite. On the whole, therefore, the disturbing force in the direction of the radius vector produces no effect on the excentricity. The force perpendicular to the radius vector increases the moon's velocity when moving from B_4 to B_1, and diminishes it when moving from B_1 to B_2; in moving, therefore, from B_4 to B_1, the excentricity is increased (65.), and in moving from B_1 to B_2, it is as much diminished (66.). Similarly in moving from B_2 to B_3, the excentricity is diminished, and in moving from B_3 to B_4, it is as much increased. This force, therefore, produces no effect on the excentricity.

On the whole, therefore, while the line of apses passes through the sun, the disturbing forces produce no effect on the excentricity of the moon's orbit.

(111.) When the line of apses is perpendicular to the line joining the earth and sun, the same thing is true. Though the forces near perigee and near apogee are not now the same as in the last case, their effects on different sides of perigee and apogee balance each other in the same way.

(112.) But if the line of apses is inclined to the line joining the earth and sun, as in *fig.* 32, the effects of the forces

Fig. 32



do not balance. While the moon is near B_4 and near B_2 the disturbing force in the radius vector is directed to the earth; at B_4 therefore, (58.), as the moon is moving towards perigee, the excentricity is increased; and at B_2, as the moon is moving from perigee, the excentricity is diminished. From the slowness of the motion at B_2, (which gives the disturbing force more time to produce its effects,) and the greatness of the force, the effect at B_2 will preponderate, and the combined effects at B_2 and B_4 will diminish the excentricity. This will appear from reasoning of the same kind as that in (98.). At B_1 and B_3, the force in the radius vector is directed from the earth: at B_1, therefore, by (59.), as the moon is moving from perigee, the excentricity is increased, and at B_3 it is diminished: but from the slowness of the motion at B_3 and the magnitude of the force, the effect at B_3 will preponderate, and the combined effects at B_1 and B_3 will diminish the excentricity. On the whole, therefore, the force in the direction of the radius vector diminishes the excentricity. The force perpendicular to the radius vector retards the moon from B_1 to B_2, but the first part of this motion may be considered near perigee, and the second near apogee, and, therefore, in the first part, it diminishes the excentricity, and in the second increases it; and the whole effect from B_1 to B_2 is very small. Similarly the whole effect from B_3 to B_4 is very small. But from B_4 to B_1, the force accelerates the moon, and therefore, by (68.), (the moon being near perigee) increases the excentricity; and from B_2 to B_3, the force also accelerates the moon, and by (68.) (the moon being near apogee) diminishes the excentricity; and the effect is much* greater (from the slowness of the moon and the greatness of the force) between B_2 and B_3 than between B_4 and B_1, and therefore the combined effect of the forces in these two quadrants is to diminish the excentricity.

On the whole, therefore, when the line of apses is inclined to the line joining the earth and sun, in such manner that the moon passes the line of apses before passing the line joining the earth and sun, the excentricity is diminished at every revolution of the moon.

(113.) In the same manner it will appear that if the line

Fig 33.

of apses is so inclined that the moon passes the line of apses after passing the line joining the earth and sun, the excentricity is increased at every revolution of the moon. Here the force in the radius vector is directed to the earth, as the moon moves from perigee and from apogee: and is directed from the earth as the moon moves to perigee and to apogee; which directions are just opposite to those in the case already considered. Also the force perpendicular to the radius vector retards the moon both near perigee and near apogee; and this is opposite to the direction in the case already considered. On the whole, therefore, the excentricity is increased at every revolution of the moon.

(114.) In every one of these cases the effect is exactly the same if the sun be supposed on the side of the moon's orbit, opposite to that represented in the figure.

(115.) Now the earth moves round the sun, and the sun therefore appears to move round the earth, in the order successively represented by the *figs.* 31, 32, and 33. Hence then; when the sun is in the line of the moon's apses, the excentricity does not alter (110.); after this it diminishes till the sun is seen at right angles to the line of apses (112.); then it does not alter (111.): and after this it increases till the sun reaches the line of apses on the other side. Consequently, the excentricity is greatest when the line of apses passes through the sun; and is least when the line of apses is perpendicular to the line joining the earth and sun.

The amount of this alteration in the excentricity of the moon's orbit is more than ⅕th of the mean value of the excentricity; the excentricity being sometimes increased by this part, and sometimes as much diminished; so that the greatest and least excentricities are nearly in the proportion of 6 : 4 or 3 : 2.

(116.) The principal inequalities in the moon's motion may therefore be stated thus:

1st. The *elliptic inequality*, or *equation of the centre* (31.), which would exist if it were not disturbed.

* To the reader who is acquainted with Newton's 3rd section, the following demonstration of this point will be sufficient. Four times the reciprocal of the *latus rectum* is equal to the sum of the reciprocals of the apogeal and perigeal distances. The effect of an increase of velocity at perigee in a given proportion is to alter the area described in a given time in the same proportion, and therefore to alter the *latus rectum* in a corresponding proportion. Consequently an increase of velocity at perigee in a given proportion alters the reciprocal of the apogeal distance by a given quantity, and therefore alters the apogeal distance by a quantity nearly proportional to the square of the apogeal distance; and therefore the ratio of the alteration of apogeal distance to apogeal distance (on which the alteration of excentricity depends) is nearly proportional to the apogeal distance. Similarly, if the velocity at apogee is increased in a given proportion, the ratio of the alteration of perigeal distance to perigeal distance, (on which the alteration of excentricity depends) is nearly proportional to the perigeal distance. Thus if the velocity were increased in the same proportion at perigee and at apogee, the increase of excentricity at the former would be greater than the diminution at the latter, in the proportion of apogeal distance to perigeal distance. But in the case before us, the proportion of increase of velocity is much greater at apogee than at perigee. First, because the force is greater, (being in the same proportion as the distance). Second, because the time in which the moon describes a given angle is greater, (being in the same proportion as the square of the distance,) so that the increase of velocity is in the proportion of the cube of the distance. Third, because the actual velocity is less, (being inversely as the distance,) so that the ratio of the increase to the actual velocity is proportional to the fourth power of the distance. Combining this proportion with that above, the alterations of excentricity in the case before us, produced by the forces acting at apogee and at perigee, are in the proportion of the cubes of the apogeal and perigeal distances respectively.

2nd. The *annual equation* (90.), depending on the position of the earth in the earth's orbit.

3rd. The *variation* (93.), and *parallactic inequality* (94.), depending on the position of the moon with respect to the sun.

4th. The general *progression of the moon's perigee* (104.).

5th. The *irregularity in the motion of the perigee*, depending on the position of the perigee with respect to the sun (109.).

6th. The *alternate increase and diminution of the excentricity*, depending on the position of the perigee with respect to the sun (115.).

These inequalities were first explained (some imperfectly) by Newton, about A.D. 1680.

(117.) The effects of the two last are combined into one called the *evection*. This is by far the largest of the inequalities affecting the moon's place: the moon's longitude is sometimes increased 1° 15′ and sometimes diminished as much by this inequality. It was discovered by Ptolemy, from observation, about A.D. 140.

(118.) It will easily be imagined that we have here taken only the principal inequalities. There are many others, arising chiefly from small errors in the suppositions that we have made. Some of these, it may easily be seen, will arise from variations of force which we have already explained. Thus the difference of disturbing forces at conjunction and at opposition, whose principal effect was discussed in (94.), will also produce a sensible inequality in the rate of progression of the line of apses, and in the dimensions of the moon's orbit. The alteration of disturbing force depending on the excentricity of the earth's orbit will cause an alteration in the magnitude of the *variation* and the *evection*. The alteration of that part mentioned in (94.) produces a sensible effect depending on the angle made by the moon's radius vector with the earth's line of apses. All these, however, are very small: yet not so small but that, for astronomical purposes, it is necessary to take account of thirty or forty.

(119.) There is, however, one inequality of great historical interest, affecting the moon's motion, of which we may be able to give the reader a general idea. We have stated in (89.) that the effect of the disturbing force is, upon the whole, to diminish the moon's gravity to the earth: and in (90.) we have mentioned that this effect is greater when the earth is near perihelion, than when the earth is near aphelion. It is found, upon accurate investigation, that half the sum of the effects at perihelion and at aphelion is greater than the effect at mean distance, by a small quantity depending on the excentricity of the earth's orbit: and, consequently, the greater the excentricity (the mean distance being unaltered) the greater is the effect of the sun's disturbing force. Now, in the lapse of ages, the earth's mean distance is not sensibly altered by the disturbances which the planets produce in its motion; but the excentricity of the earth's orbit is sensibly diminished, and has been diminishing for thousands of years. Consequently the effect of the sun in disturbing the moon has been gradually diminishing, and the gravity to the earth has therefore, on the whole, been gradually increasing. The size of the moon's orbit has therefore, gradually, but insensibly, diminished (47.): but the moon's place in its orbit has sensibly altered (49.), and the moon's angular motion has appeared to be perpetually quickened. This phænomenon was known to astronomers by the name of the *acceleration of the moon's mean motion*, before it was theoretically explained in 1787, by Laplace: on taking it into account, the oldest and the newest observations are equally well represented by theory. The rate of progress of the moon's line of apses has, from the same cause, been somewhat diminished.

Section VI.—*Theory of Jupiter's Satellites.*

(120.) Jupiter has four satellites revolving round him in the same manner in which the moon revolves round the earth; and it might seem, therefore, that the theory of the irregularities in the motion of these satellites is similar to the theory of the irregularities in the moon's motion. But the fact is, that they are entirely different. The fourth satellite (or that revolving in the largest orbit) has a small irregularity analogous to the moon's variation, a small one similar to the evection, and one similar to the annual equation: but the last of these amounts only to about two minutes, and the other two are very much less. The corresponding inequalities in the motion of the other satellites are still smaller. But these satellites disturb each other's motions, to an amount and in a manner of which there is no other example in the solar system; and (as we shall afterwards mention) their motions are affected in a most remarkable degree by the shape of Jupiter.

(121.) The theory, however, of these satellites is much simplified by the following circumstances:—First, the disturbances produced by the sun may, except for the most accurate computations, be wholly neglected. Secondly, that the orbits of the two inner satellites have no excentricity independent of perturbation. Thirdly, that a very remarkable relation exists (and, as we shall show, necessarily exists) between the motions of the three first satellites.

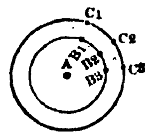
Before proceeding with the theory of the first three satellites, we shall consider a general proposition which applies to each of them.

(122.) Suppose that two small satellites revolve round the same planet; and that the periodic time of the second is a very little greater than double the periodic time of the first; what is the form of the orbit in which each can revolve, describing a curve of the same form at every revolution?

(123.) The orbits will be sensibly elliptical, as the perturbation produced by a small satellite in one revolution will not sensibly alter the form of the orbit. The same form being supposed to be described each time, the major axis and the excentricity are supposed invariable, and the position of the line of apses only is assumed to be variable. The question then becomes, What is the excentricity of each orbit, and what the variation of the position of the line of apses, in order that a curve of the same kind may be described at every revolution?

(124.) In *fig.* 34, let B_3, B_1, B_2, represent the orbit of the first, and C_3, C_1, C_2, the orbit of the second. Suppose that when B was at B_1, C was at C_1, so that A, B_1, C_1, were in

Fig. 34.



the same straight line, or that B and C were in conjunction at these points. If the periodic time of C were exactly double of the periodic time of B, B would have made exactly two revolutions, while C made exactly one; and, therefore, B and C would again be in conjunction at B_1 and C_1. But as the periodic time of C is a little longer than double that of B, or the angular motion of C rather slower than is supposed, B will have come up to it (in respect of longitude as seen from A) at some line B_2 C_2, which it reaches *before* reaching the former line of conjunction B_1 C_1. And it is plain that there has been no other conjunction since that with which we started, as the successive conjunctions can take place only when one satellite has gained a whole revolution on the other. The first conjunction then being in the line A B_1 C_1, the next will be in the line A B_2 C_2, the next in a line A B_3 C_3, still farther from the first, &c.; so that the line of conjunction will regress slowly; and the more nearly the periodic time of one satellite is double that of the other, the more slowly will the line of conjunction regress.

(125.) As the principal part of the perturbation is produced when the satellites are near conjunction, (in consequence of the smallness of their distance at that time,) it is sufficiently clear that the position of the line of apses, as influenced by the perturbation, must depend on the position of the line of conjunction; and, therefore, that the motion of the line of apses must be the same as the motion of the line of conjunction. Our question now becomes this: What must be the excentricities of the orbits, and what the positions of the perijoves, in order that the motions of the lines of apses, produced by the perturbation, may be the same as the motion of the line of conjunction?

(126.) If the line of apses of the first satellite does not coincide with the line of conjunction, the first satellite at the time of conjunction will either be moving from perijove towards apojove, or from apojove towards perijove. If the former, the disturbing force, which is directed from the central body, will, by (59.), cause the excentricity to increase; if the latter, it will cause it to decrease. As we have started with the supposition, that the excentricity is to be supposed invariable, neither of these consequences can be allowed,

and, therefore, the line of apses must coincide with the line of conjunction.

(127.) If the apojove of the first satellite were in the direction of the points of conjunction, the disturbing force in the direction of the radius vector, being directed from the central body, would, by (54.), cause the line of apses to progress. Also the force perpendicular to the radius vector, before the first satellite has reached conjunction, (and when the second satellite, which moves more slowly, is nearer to the point of conjunction than the first,) tends to accelerate the first satellite; and that which acts after the satellites have passed conjunction, tends to retard the first satellite; and both these, by (65.) and (66.), cause the line of apses to progress. But we have assumed, that the line of apses shall move in the same direction as the line of conjunction, that is, shall regress; therefore, the apojove of the first satellite cannot be in the direction of the points of conjunction.

(128.) But if we suppose the perijove of the first satellite to be in the direction of the points of conjunction, every thing becomes consistent. The disturbing force, in the direction of the radius vector, from the central body, will, by (51.), cause the line of apses to regress. The force perpendicular to the radius vector, which accelerates the first satellite before it has reached conjunction, that is, before it has reached the perijove, and retards it after that time, will also, by (65.) and (66.), cause the line of apses to regress. Also, as in (56.), this regression will be greater as the excentricity of the orbit is less, because the disturbing force, which acts here, does not depend on the excentricity. By proper choice, therefore, of a value of the excentricity, we can make an orbit, whose line of apses will always regress exactly as fast as the line of conjunction, and will, therefore, always coincide with it; whose excentricity, in consequence, will never alter, by (59.) and (68.); and whose general shape, therefore, will be the same at every successive revolution.

(129.) We shall mention hereafter, that the form of Jupiter is such as would cause the perijove of the first satellite, if it were not disturbed by the second satellite, to progress with a velocity not depending upon the excentricity of the orbit. The only alteration which this makes in our conclusions is, that the excentricity of the orbit must be so chosen, that the perturbation of which we have spoken will cause a regression equal to the *sum* of the progression which Jupiter's shape would occasion, and the regression of the line of conjunction. As this is greater than the regression of the line of conjunction alone, the excentricity of the orbit must be less. So that the only effect of Jupiter's shape is to diminish, in some degree, the excentricity of the orbit.

(130.) Now let us inquire what must be the form and position of the orbit of the second satellite. As before, the principal part of the perturbation is near conjunction. At and near the conjunction, the disturbing force, in the direction of the radius vector, is directed to the central body. Before conjunction, when the first satellite is less advanced than the second, the disturbing force, perpendicular to the radius vector, retards the second, by (86.). For, the periodic time of the second being nearly double that of the first, the mean distances from the planet will be nearly in the proportion of 7 to 11, (as the proportion of the cube of 7 to the cube of 11 is nearly the same as the proportion of the square of 1 to the square of 2, see (34.),) and, therefore, near conjunction, the distance of the first from the second is less than the distance of the first from the central body. After conjunction, the disturbing force accelerates the second body. Now, without going through several cases as before, which the reader will find no trouble in doing for himself, we shall remark, at once, that if the apojove of the second satellite is in the direction of the points of conjunction, both the disturbing force, directed to the central body at apojove, and that perpendicular to the radius vector, retarding it before it reaches apojove, and accelerating it afterwards, by (53.), (65.), and (66.), will cause the line of apses to regress; and that, by proper choice of excentricity, the regression of the line of apses may be made exactly equal to the regression of the line of conjunction.

(131.) Our conclusion, therefore, is: If two satellites revolve round a primary, and if the periodic time of one is very little greater than double the periodic time of the other, and if we assume that the orbits described have always the same form; (that is, if they have no excentricity independent of perturbation;) then the orbits will not sensibly differ from ellipses, the lines of apses of both orbits must always coincide with the line of conjunctions, and the perijove of the first orbit, and the apojove of the second, must always be turned towards the points of conjunction. It appears also, that these conditions are sufficient, inasmuch as the rate of regress of the lines of apses will (with proper values for the excentricities) be the same as the rate of regress of the line of conjunctions, and the excentricities then will not change. The excentricities of the orbits will be greater as the regress of the line of conjunctions is slower, or as the proportion of the periodic times approaches more exactly to the proportion of 1 : 2.

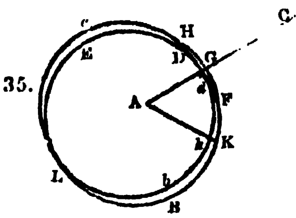
(132.) In the same manner it would be found, that if the periodic time of one satellite were very little less than double that of the other, the lines of apses (in order that similar orbits may be traced out at each revolution) must always coincide with the line of conjunction, and the apojove of the first satellite and the perijove of the second must always be turned towards the points of conjunction; and the excentricities of the orbits must be greater, as the proportion of the periodic times approaches more exactly to the proportion of 1 : 2.

(133.) The same thing exactly would hold, if the periodic times were very nearly in the ratio of 2 : 3, or of 3 : 4, &c., but these suppositions do not apply to Jupiter's satellites.

(134.) Having thus found the distortion produced by the disturbing force in orbits which have no excentricity independent of perturbation, it will easily be imagined, that the same kind of distortion will be produced if the orbits have an original excentricity. If we make, in an elliptic orbit, the same kind of alteration which must be made in a circular orbit, in order to form the figure found above, we shall have nearly the orbit that will be described from the combined effects of perturbation and of excentricity independent of perturbation.*

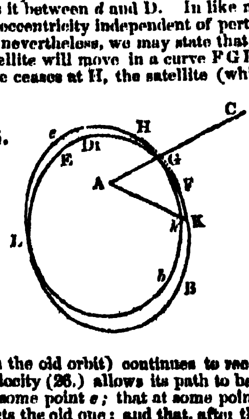
* The truth of this proposition may be shown more fully in the following manner:—Let A, *fig.* 35, be the place of the primary, A C the line of conjunctions of the first and second satellite, B D E the elliptic orbit, in which the first satellite would move if undisturbed, D its perijove. Suppose (to simplify the figure) that the attraction of the second satellite acts only for a limited space; for instance, while the first satellite passes from F to H. Then the result of the investigations from (122.) to (131.) is, that the first satellite will be drawn

Fig. 35.



outwards from the orbit in which it would have moved, so as to describe a curve F G H; and when the disturbing force ceases at H, it will proceed to describe an ellipse, H *e b d*, similar to B D E, but with this difference, that the perijove is at *d* instead of D. The conclusion, however, now that it has been securely obtained from the reasoning above, may be stated as the result of the following reasoning:—In consequence of the disturbing force, which has drawn the first satellite outwards, without, upon the whole, altering its velocity, (accelerating it before conjunction, and retarding it afterwards,) the satellite has moved in a curve, F G H, external to the ellipse F D, in which it would have moved; and after the disturbing force has ceased at H, the satellite (which is moving in a path inclined externally from the old orbit) continues to recede from the old orbit till the diminution of velocity (26.) allows its path to be so much curved, that at *e* it begins to approach, and at L the new orbit intersects the old one; and after this, the path is inclined internally from the old orbit, till the increase of velocity (25.) makes its path so little curved that it approaches the old orbit again, and again crosses it between *d* and D. In like manner, if, as in *fig.* 36, the orbit B F E have an excentricity independent of perturbation, (the perijove being at any point D_1,) nevertheless, we may state that, in consequence of the disturbing force, the satellite will move in a curve F G H external to F E; but when the disturbing force ceases at H, the satellite (which is moving in a path

Fig. 36.



inclined externally from the old orbit) continues to recede from the old orbit till the diminution of velocity (26.) allows its path to be so much curved, that it begins to approach at some point *e*; that at some point L, nearly opposite to C, the new orbit intersects the old one; and that, after this, the path is inclined internally from the old orbit, till the increase of velocity (25.) makes its path so little curved that it approaches the old orbit again, and again crosses it between F and H. Thus, the alteration of the radius vector, drawn in any given

We shall now proceed with the application of these conclusions to Jupiter's first three satellites.

(135.) The periodic time of Jupiter's first satellite is, 1 day, 18 hours, 27 minutes, and 34 seconds; that of the second satellite is, 3 days, 13 hours, 13 minutes, and 42 seconds; that of the third satellite is, 7 days, 3 hours, 42 minutes, and 32 seconds. The periodic time of the second satellite exceeds, by a small quantity, double that of the first, so that the preceding investigations apply to the motion of these two satellites. In fact, 275 revolutions of the first satellite are finished in almost exactly the same time as 137 revolutions of the second. If then, at a certain time, these two satellites start from conjunction, they will be in conjunction near the same place at every revolution of the second satellite, or at every second revolution of the first satellite: but the line of conjunction will regress slowly; and when the first satellite has finished 275 revolutions, or one revolution more than double the number made by the second satellite, they will again be in conjunction in the same place as before, the line of conjunction having regressed till it has again reached the same position: this takes place in 486½ days.

(136.) From the preceding investigation then it appears that, as these orbits have no excentricity independent of perturbation, they will be elliptic, and the line of apses of each orbit will regress so as to turn completely round in 486½ days; and that when in conjunction, the first satellite will always be in perijove, and the second satellite will always be in apojove.

(137.) But the periodic time of the third satellite is almost exactly double that of the second satellite, exceeding the double by a small quantity; and on this account the orbit of the second satellite will be distorted from the form which otherwise it would have had, by an inequality similar to that just investigated. In a word, the line of conjunction of the second and third satellites will slowly regress, and the orbit of the second satellite will always be compressed on the side next the points of conjunction, and elongated on the opposite side; and the orbit of the third satellite will always be elongated on the side next the points of conjunction, and compressed on the opposite side.

(138.) Now we come to the most extraordinary part of this theory. We have remarked that 275 revolutions of the first satellite are finished in almost exactly the same time as 137 revolutions of the second; but it will also be found that 137 revolutions of the second are finished in almost exactly the same time as 68 revolutions of the third: all these revolutions occupying 486½ days. Because 275 exceeds the double of 137 by 1, we have inferred that the line of conjunctions of the first and second satellites regresses completely round in 275 revolutions of the first satellite, or in 486½ days. In like manner, because 137 exceeds the double of 68 by 1, we infer that the line of conjunctions of the second and third satellites regresses completely round in 137 revolutions of the second satellite, or in 486½ days. Hence we have this remarkable fact: *the regression of the line of conjunction of the second and third satellites is exactly as rapid as the regression of the line of conjunction of the first and second satellites.* So accurate is this law, that in the thousands of revolutions of the satellites, which have taken place since they were discovered, not the smallest deviation from it (except what depends upon the elliptic form of the orbit of the third satellite) has ever been discovered.

(139.) Singular as this may appear, the following law is not less so. *The line of conjunction of the second and third satellites always coincides with the line of conjunction of the first and second satellites produced backwards, the conjunctions of the second and third satellites always taking place on the side opposite to that on which the conjunctions of the first and second take place* This defines the relative position of the lines of conjunction, which (by the law of last article) is invariable. Like that law it has been found, as far as observation goes, to be accurately true in every revolution since the satellites were discovered.

(140.) The most striking effect of these laws in the perturbations of the satellites is found in the motions of the second satellite. In consequence of the disturbing force of the first satellite, the orbit of the second satellite will be elongated towards the points of conjunction of the first and second (130.), and consequently compressed on the opposite side. In consequence of the disturbing force of the third satellite, the orbit of the second satellite will be compressed on the side next the points of conjunction of the second and third (128.). And because the points of conjunction of the second and third are always opposite to the points of conjunction of the first and second, the place of compression from one cause will always coincide with the place of compression from the other cause; and therefore the orbit of the second satellite will be very much compressed on that side, and consequently very much elongated on the other side. The excentricity of the orbit, depending thus entirely on perturbation, exceeds considerably the excentricity of the orbit of Venus. The inqualities in the motions of the satellites, produced by these excentricities, were first discovered (from observation) by Bradley about A.D. 1740, and first explained from theory by Lagrange, in 1766.

(141.) The singularity of these laws, and the accuracy with which they are followed, lead us to suppose that they do not depend entirely on chance. It seems natural to inquire whether some reason may not be found in the mutual disturbance of the satellites, for the preservation of such simple relations. Now we are able to show that, supposing the satellites put in motion at any one time, nearly in conformity with these laws, their mutual attraction would always tend to make their motions follow these laws exactly. We shall show this by supposing a small departure from the law, and investigating the nature of the forces which will follow as a consequence of that departure.

(142.) Suppose, for instance, that the third satellite lags behind the place defined by this law; that is, suppose that when the second satellite is at the most compressed part of its ellipse, (as produced by the action of the first satellite,) the third satellite is behind that place. The conjunction then of the second and third satellites will happen before reaching the line of apses of the orbit of the second, as produced by the action of the first. Now in the following estimation of the forces which act on the third satellite, and of their variation depending on the variation of the positions of the lines of conjunction, there is no need to consider the influence which the ellipticity of the orbit of the second as produced by the third, or that of the third as produced by the second, exerts upon the third satellite; because the flattening arising from the action of the third, and the elongation arising from the action of the second, will always be turned towards the place of conjunction of the second and third, and the modification of the action produced by this flattening and elongation will always be the same, whether the lines of conjunction coincide or not. In *fig* 37, let C be the perijove of the orbit of the second satellite, (as produced by the action of the 1st satellite alone,) D the point of the orbit of the third, which is in the line A C produced. If the third satellite is at D when the second is at C, the force produced by the second perpendicular to the radius vector, retards the third before it reaches D, and accelerates it after it has passed D, by equal quantities. But if, as in the supposition which we have made, the conjunction takes place in the line A C_1 D_1, the retardation of the third satellite before conjunction is

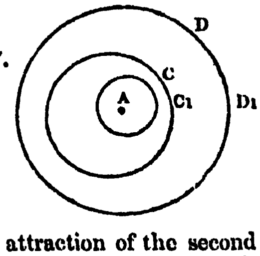
direction, as A K (which in the new orbit is altered to A *k*) is nearly the same in the second case as in the first. This, however, is the alteration produced in a single revolution of the satellite; but as the same applies to every successive revolution, it follows that the inequality or variation of the radius vector in the second case is nearly the same as in the first case; and thus the proposition of the text is proved.

The inequality of the radius vector would be somewhat different if the excentricity of the orbit in the second case were considerable, partly because the places of conjunction would not be at equal angular distances, partly because the disturbing forces would be different, (as the distance between the satellites in conjunction would not always be the same,) and partly because the effect of a given force is really different, according to the part of the orbit at which it acts. But where the excentricity is so small, as in the orbit of Jupiter's third satellite, or in those of the old planets, the alteration of the inequality of the radius vector produced by these differences is hardly sensible.

The reasoning of this note may be applied, with the proper alterations, to every case of perturbation, produced by a disturbing force which is nearly independent of the form of the orbit; and as this will apply successively to each of the causes producing disturbance, we shall at last arrive at the following general proposition:—If several disturbing forces act on a planet or satellite, and if we estimate the inequality in the radius vector, which each of these would produce, supposing the orbit to have no excentricity independent of perturbation; then the inequality really produced, supposing the orbit to have an independent excentricity, will be nearly the same as the sum of all the inequalities so estimated.

It is to be remarked, that if an orbit have an independent excentricity, and if the orbit receive an alteration similar to an elliptic inequality, (that is, if it be elongated on one side and flattened on the other,) the orbit is still sensibly an ellipse, of which the original focus is still the focus. Thus, in the instance occupying the first part of this note, as the inequality impressed on the elliptic orbit in the second case is the same as the inequality in the first case, that is, is similar to an elliptic inequality, the orbit so altered will still be an ellipse, whose excentricity and line of apses are altered. We might, therefore, have obtained our results by at once investigating the alterations of the excentricity and line of apses produced by the disturbing forces; but the method adopted in the text is simpler.

Fig. 37.



produced by the attraction of the second satellite before it arrives at perijove, when it is near to the orbit of the third satellite, (and therefore acts powerfully,) and moves slowly, (and therefore acts for a long time); while the acceleration after conjunction is produced by the second satellite near its perijove, when it is far from the orbit of the third satellite, (and therefore acts weakly,) and moves rapidly (and therefore acts for a short time). The retardation therefore exceeds the acceleration; and the consequence is, by (48.), that the periodic time of the third satellite is shortened, and therefore its angular motion is quickened; and therefore, at the next conjunction, it will have gone further forward before the second satellite can come up with it, or the line of conjunction will be nearer to the place of perijove of the second satellite, depending on the action of the first. In the same manner, if we supposed the third satellite moving rather quicker than it ought in conformity with the law, the tendency of the forces would be to accelerate it, to make its periodic time longer, and thus to make its angular motion slower. By the same kind of reasoning it will be seen that there are forces acting on the first satellite, produced by the elliptic inequality which the third impresses on the orbit of the second, tending to accelerate the angular motion of the first satellite in the first case, and to retard it in the second. The same reasoning will also show that both the first and third satellites exert forces on the second, tending to retard its angular motion in the first case, and to accelerate it in the second. All these actions tend to preserve the law: in the first case by making the line of conjunctions of the first and second satellite regress, and that of the second and third progress, till they coincide; and in the second case, by altering them in the opposite way, till they coincide.

(143.) Perhaps there is no theoretical permanence of elements on which we can depend with so great certainty, as on the continuance of this law. The greatest and most irregular perturbations of Jupiter or of his satellites, provided they come on gradually, will not alter the relation between their motions; the effect of a resisting medium will not alter it; though each of these causes would alter the motions of all the satellites; and though similar causes would wholly destroy the conclusions which mathematicians have drawn as to the stability of the solar system, with regard to the elements of the planetary orbits. The physical explanation of this law was first given by Laplace, in A.D. 1784.

(144.) We have terminated now the most remarkable part of the theory of these satellites. There are however some other points which are worth attending to, partly for their own sake, and partly as an introduction to the theory of the planets.

(145.) The orbit of the third satellite, as we have mentioned, has a small excentricity independent of perturbation. Consequently, when the conjunction with the second takes place near the independent perijove of the third, the effect of the disturbance on the second is rather greater than at any other time; and this produces an irregularity in the excentricity of the second, and in the motion of its apses, depending on the distance of the line of conjunction from the independent perijove of the third. The departure from uniformity in the angular motion of the third also produces a departure from uniformity in the regression of the line of conjunction, and this contributes to the same irregularity.

(146.) The disturbing force in the direction of the radius vector, produced by an inner satellite, is sometimes directed to the central body and sometimes from it; but on the whole the former exceeds the latter. (86.) Now the principal part of the effect really takes place when the satellites are near conjunction; consequently, when the line of conjunction passes near the independent perijove of the third satellite, the force by which the third satellite is urged to the planet is greater than at any other time; and as the line of conjunction revolves, the force alternately increases and diminishes. This produces an irregularity in the major axis, and consequently in the motion of the third satellite (47.), depending on the distance of the line of conjunction from the perijove of the third.

(147.) The disturbing force in the direction of the radius vector produced by an outer satellite is sometimes directed to the central body and sometimes from it; but on the whole the latter exceeds the former. (80.) For the reasons therefore, in the last article, there is in the motion of the second satellite an irregularity depending on the distance of the line of conjunction from the independent perijove of the third, but opposite in its nature to that of the third satellite.

(148.) Each of these irregularities in the motion of one of these satellites produces an irregularity in the motion of the others; and thus the whole theory becomes very complicated when we attempt to take the minute irregularities into account.

(149.) The motion of the fourth satellite is not related to the others in the same way in which they are related among themselves. Its periodic time is to the periodic time of the third nearly in the proportion of 7 : 3. Some of the irregularities then which it experiences and which it occasions are nearly similar to those in the motions of the planets. These however are small: the most important are those depending on the changes in the elements which require many revolutions of the satellites to go through all their various states, but which nevertheless have been observed since the satellites were discovered. We shall proceed with these.

(150.) First, let us suppose that the third satellite has no excentricity independent of perturbation, and that the fourth satellite has a sensible excentricity, its line of apses progressing very slowly, in consequence principally of the shape of Jupiter (so slowly as not to have gone completely round in eleven thousand revolutions of the satellite). When each of the satellites has revolved a few hundred times round Jupiter, their conjunctions will have taken place almost indifferently in every part of their orbits. If the orbit of the fourth as well as that of the third had no independent ellipticity, there would be no remarkable change of shape produced by perturbation, as the action of one satellite upon the other would be the same when in conjunction in all the different parts of the orbit. But the orbit of the fourth being excentric, the action of each satellite on the other is greatest when the conjunction happens near the perijove of the fourth satellite. We may consider then that the preponderating force takes place at this part of the orbits; and we have to inquire what form the orbit of the third satellite must have, to preserve the same excentricity at every revolution. It must be remembered here that the effect of Jupiter's shape is to cause a more rapid progress of the line of apses of the third satellite, if its orbit be excentric, than of the line of apses of the fourth.

(151.) Considering then that the preponderating force on the third satellite in the direction of the radius vector is directed from the central body towards the perijove of the fourth, and that the preponderating force perpendicular to the radius vector accelerates it as it approaches that part, and retards it afterwards, it is plain from (51.), (65.), and (66.), that if the perijove of the third satellite were in that position, the forces would cause the line of apses to regress; and this regression, if the excentricity of the third be small, may be considerable (though the preponderance of force which causes it is extremely small), and may overcome so much of the progression caused by Jupiter's shape, as to make the real motion of the line of apses as nearly equal as we please to the motion of the line of apses of the fourth. But the motion of the line of apses of the fourth will itself be affected (though very little) by the greater action of the third satellite on it at the same place; and the part in the radius vector being directed at its perijove to the central body, and the part perpendicular to the radius vector retarding it before it reaches the perijove, and accelerating it afterwards, will cause a small increase of progression of its apse. The state of things will be permanent, so far as depends on these forces, when the increased progression of the apse of the fourth satellite is equal to the diminished progression of the apse of the third; and thus the progression of the apse of the fourth will be somewhat increased, and the third satellite's orbit will have a compression corresponding in direction to the perijove of the fourth, and an elongation in the same direction as the apojove of the

fourth. This would be the case if the third satellite had no excentricity independent of perturbation; but we may, as in other cases, consider that the same kind of distortion will be produced in the orbit if it has an independent excentricity.

(152.) Now let us suppose the fourth satellite to have no excentricity independent of perturbation, and the third satellite to have an independent excentricity. The greatest action will now be at the apojove of the third satellite, and this will (though in a small degree) cause the line of apses of the third satellite to progress; that is, it will increase the rapidity of progression which Jupiter's shape gives it. If now we wish to discover the form of orbit of the fourth satellite which will at every revolution preserve the same excentricity, and have its line of apses always corresponding with that of the third satellite, and therefore progressing more rapidly than the shape of Jupiter alone would make it progress, we must evidently suppose the perijove of the fourth satellite turned towards the apojove of the third, and, by supposing the excentricity small enough, the progression may be made as rapid as we please. Thus the effect of excentricity in the orbit of the third satellite is, that its line of apses is made to progress rather more rapidly, and that the orbit of the fourth satellite is compressed on the side next the apojove of the third satellite, and elongated on the opposite side. We have supposed for this investigation that the fourth satellite had no excentricity independent of perturbation, but the conclusion as to the distortion of the orbit may be applied if we suppose it to have independent excentricity.

(153.) In fact, the orbits of both the third and fourth satellites have independent excentricities, and both our conclusions apply to them. The fourth satellite, besides its independent excentricity, has an excentricity impressed upon it, opposite in kind to that of the third; and the third satellite, besides its independent excentricity, has an excentricity impressed upon it of the same kind as that of the fourth. In the same manner, the orbits of the first and second satellites have small excentricities impressed on them, similar in their kind to those of the third and fourth.

(154.) It will readily be conceived that the excentricities of the orbit of the third satellite will affect the great inequality (137.), which it produces in the motion of the second; and on the contrary, that the inequality in the motion of the third produced by the attraction of the second, will influence the effect of the third on the fourth. We shall not however notice these further than to state that their effects are small.

(155.) We have now gone over the principal inequalities of the motions of Jupiter's satellites. They are so much connected, and (as we may say) so completely entangled, that though they may be explained in the way in which we have considered them, it would hardly be possible to calculate them in that way. A mathematical process of the most abstruse kind, which will at the same time embrace the motions of all, is alone competent to this object. We shall however have attained our end if we have given the reader a general idea of the explanation of disturbances in the most curious and complicated system that has ever been reduced to calculation.

SECTION VII.—*Theory of Planets.*

(156.) The theory of the planets may be considered as holding a middle place between that of our moon and that of Jupiter's satellites. In our moon, the principal inequalities are those that exhibit themselves in nearly the same order at every revolution, or, at longest, in the earth's revolution round the sun, depending entirely upon the relative position of the moon, the sun, and the lines of apses. In Jupiter's satellites, some of the principal inequalities (as those of the third and fourth satellites) do not depend at all upon the relative position of the bodies, but depend on the position of the lines of apses, whose revolutions, though slow, may yet be completely observed. But in the planets the terms analogous to those which we have mentioned in the moon's motions are small; the changes of elements are so slow, that, though they may be in some degree observed, many thousands of years would be necessary to observe them completely. The most remarkable irregularities are those produced by changes in the elements occupying several revolutions of the planets, and more nearly analogous to the mutual perturbations of the three first satellites of Jupiter than to any other that we have seen; differing from them however in this respect, that for most of them independent excentricities are quite essential.

(157.) There are, however, some terms very nearly similar to those mentioned in the theory of the moon. Suppose, for instance, we consider the perturbations of Mercury by Jupiter (whose distance from the sun is more than thirteen times as great). This case is almost exactly analogous to the case of the moon disturbed by the sun. And in consequence, Mercury's orbit is flattened a little on the sides nearest to and farthest from Jupiter; but this effect is much disguised by the effect of forces analogous to those mentioned in (94.), which here preponderates greatly: his line of apses progresses a little at every revolution, when Jupiter is nearly in that line, and regresses a little when Jupiter is in the line perpendicular to it: his orbit is a little more excentric in the former case, and a little less so in the latter; and his orbit is a little larger when Jupiter is at perihelion than when at aphelion. The same thing applies very nearly to the disturbances of Venus, the Earth, and Mars, produced by Jupiter.

(158.) The instance taken above is almost an extreme one. When we consider the perturbations of two planets which are nearer to each other, we are obliged to alter our conclusions considerably. The disturbing force becomes so much greater where the planets are near conjunction than at any other part, that the orbit is much more changed there than at any other part. However, the reasoning upon which, in (91.), we determined the form of the moon's orbit, laying aside the consideration of independent excentricity, will, to a certain extent, apply here. The orbit in several cases will be flattened on the side where conjunction takes place, and on the opposite side, but generally most so on the latter; and will be made protuberant at the parts where the disturbing force tends wholly to increase the gravitation towards the sun. The same general reasoning will, in many cases, help us to find the form of the orbit which is influenced by the attraction of an interior planet.

(159.) A consideration, however, of particular cases will show how cautious we must be in applying this conclusion. Suppose, for instance, we consider the reciprocal perturbations of the Earth and Mars. The periodic time of Mars is nearly double that of the Earth. Here, then, we fall upon an inequality of the same kind as that discussed in (122.), &c., for the satellites of Jupiter. And though the periodic time of Mars is not *very* nearly double that of the Earth, so that the distortions produced in the orbits of the Earth and Mars are not very striking; still they are the greatest (of those depending only on the position of the planets) which these two bodies produce in each other's motions. Here, then, the disturbance, which on a hasty view we might suppose analogous to the *variation* of the Moon, becomes, from the small disproportion of distances, and the near commensurability of the periodic times, much more nearly similar to the slow variation of the elements of orbits.

(160.) It seems quite hopeless to attempt to give a notion of the calculations by which, in all the different cases, the disturbances independent of the excentricities can be computed. It is sufficient to state, that the same methods apply to all, and that they are much more simple than those relating to other points, of which an idea may be given by general explanation.

(161.) Let us now consider the inequalities of motion which depend on the excentricities and inclinations of the planets' orbits. The idea that will probably first occur to the reader is this. 'If the disturbances of the planets, supposing their orbits to have no independent excentricities, amount only to a few seconds, how is it likely that the small alterations of place, which are produced by the trifling excentricities and inclinations of their orbits, will so far alter their forces upon each other as to produce any sensible difference in the magnitude of irregularities which are already insignificant?' In answer to this we must say, 'It is true that these forces, or alterations of forces, are exceedingly small, and those parts of them which act in the same direction for a short time only (as for a fraction of the periodic time of a planet) do not produce any sensible effect. But we can find some parts of them which act in the same manner during many revolutions; and this in many cases where no disturbance can be found, independent of the excentricities, similar to those discussed in (122.) &c.; the effects of these may grow up in time to be

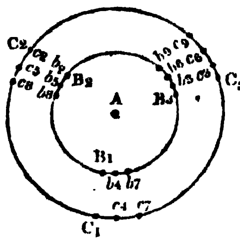
sensible; and those in particular which alter the mean distance and the periodic time may produce in time an effect on the longitude of the planet (49.), very much more conspicuous than that in the alteration of the orbit's dimensions.'

(162.) In this consideration is contained the whole general theory of those inequalities known by the name of *inequalities of long period.* They are the only ones depending on the excentricities (besides those similar to the moon's evection) which ever become important.

(163.) To enter more minutely into the explanation, let us take the instance of the long inequality of Jupiter and Saturn: the most remarkable for its magnitude, and for the length of time in which the forces act in the same manner, as well as for the difficulty which it had given to astronomers before it was explained by theory, that has been noticed since the first explanation of the Moon's irregularities.

(164.) The periodic times of Jupiter and Saturn are very nearly in the proportion of 2 to 5, (the periodic times being 4332 days, 17 hours, and 10,759 days, 5 hours,) or the number of degrees of longitude that they will describe in the same time, omitting all notice of their excentricities, will be in the proportion of 5 to 2 nearly. Suppose, now, that they were exactly in the proportion of 2 to 5; and suppose that Jupiter and Saturn started from conjunction; when Saturn has described 240 degrees, Jupiter will have described 600 degrees (as these numbers are in the proportion of 2 to 5): but as 360 degrees are the circumference, Jupiter will have gone once round, and will besides have described 240 degrees. It will, therefore, again be in conjunction with Saturn. When Saturn has again described 240 degrees, that is, when Saturn has described in all 480 degrees, or has gone once round and has described 120 degrees more, Jupiter will have described 1200 degrees, or will have gone three times round and described 120 degrees more, and, therefore, will again be in conjunction with Saturn. When Saturn has again described 240 degrees, that is, when it has gone exactly twice round, Jupiter will have gone exactly five times round, and they will again be in conjunction. So that, if the periodic times were exactly in the proportion of 2 to 5, there would be a continual succession of conjunctions at the points whose longitudes exceeded the longitude of the first place of conjunction by 240°, 120°, 0°, 240°, 120°, 0°, &c. Thus, in *fig.* 38, if B_1 is the place of Jupiter at first, and C_1 that of Saturn, Jupiter will have gone quite round, and also as far in the next revolution as B_2, while Saturn has described part of a revolution only to C_2: then Jupiter will again have gone quite round, and also as far in the next revolution as B_3, while Saturn has described part of a revolution to C_3: then Jupiter will have performed a whole revolution, and part of another to B_1, while Saturn has performed part of a revolution to C_1: and then the same order of conjunctions will go on again. If, then, the periodic times were exactly in the proportion of 2 to 5, the conjunctions would continually take place in the same three points of the orbits. This conclusion will not be altered by supposing the orbits excentric: for though the places of conjunction may then be somewhat altered, the conjunctions, after the third, (when Saturn has gone round exactly twice, and Jupiter exactly five times,) will go on in the same order, and happen at the same places as before.

Fig. 38.



(165.) But the periodic times are not exactly in the proportion of 2 to 5, but much more nearly in the proportion of 29 : 72. This alters the distance of the places of conjunction. We must now suppose Saturn to move through 242°·79, and Jupiter (by the proportion just mentioned) will then have moved through 602°·79, or through a whole circumference and 242°·79, and they will be in conjunction again. The next conjunction will take place when Saturn has moved through double this angle, or 485°·58, or when Saturn has performed a whole revolution, and 125°·58 of the next revolution: and the following conjunction will take place when Saturn has moved through 728°·37, or when Saturn has gone twice round, and has described 8°·37 more. Now, then, the same order of conjunctions will not go on again at the same places as before, but the next three after this will be shifted 8°·37 before the former places, the three following the last-mentioned three will be again shifted 8°·37, and so on. The places of successive conjunction, in *fig.* 38, will be at B_1 C_1, b_2 c_2, b_3 c_3, b_4 c_4, b_5 c_5, b_6 c_6, &c. The shifting of the places of conjunction will take place in nearly the same manner, whether the orbits are excentric or not.

(166.) From this the following points are evident:—

First. In consequence of the periodic times being nearly in the proportion of 2 to 5, many successive conjunctions happen near to three equidistant points on the orbits.

Secondly. In consequence of the proportion being not exactly that of 2 : 5, but one of rather less inequality, the points of conjunction shift forward, so that each successive set of conjunctions is at points of the orbits more advanced, by 8°·37, than the preceding one.

(167.) Let us now inquire how long it will be before the conjunctions happen at the same parts of the orbits as at first.

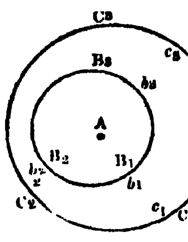
This will be when the series of points b_4, b_7, b_{10}, &c., extends to B_3. For then the series b_5, b_8, b_{11}, &c., will extend to B_1, and the series b_3, b_6, b_9, &c., will extend to B_2. The time necessary for this will be gathered from the consideration, that in three conjunctions the points are shifted 8°·37: and that the points must shift 120° from B_1, before they reach B_2: and that we may, therefore, use the proportion, As 8°·37 is to 3, so is 120° to 43 nearly, the number of conjunctions that must have passed before the points of conjunction are again the same. And as Saturn advances 242°·79 between any conjunction and the next, he will, at the forty-third conjunction from the first, have described 10440°, or 29 circumferences; and Jupiter, therefore, (by the proportion of their periodic times,) will have described 72 circumferences. The time, then, in which the conjunctions return to the same points is twenty-nine times Saturn's periodic time, or seventy-two times Jupiter's periodic time, or about 855 years.*

(168.) Now let us examine into the effects of this slow motion of the points of conjunction upon the forces which one body exerts to disturb the other.

(169.) If the orbits had no independent excentricity, it would affect them no further than by the periodical distortion which would take place at every conjunction. There would be nothing in one set of conjunctions, more than in another, which could affect the dimensions of the orbits.

(170.) But if the orbits are not circular, this is no longer true. It is not the same thing whether the conjunctions take place at B_1 C_1, B_2 C_2, and B_3 C_3, *fig.* 39, or at b_1 c_1, b_2 c_2, and b_3 c_3.

Fig. 39.



The distances of the planets are not the same, and consequently the forces which they exert on each other are not the same; also their velocities are different in different parts of their orbits, or at different points of conjunction, and therefore the times during which they can act on each other are not the same. It is true that, in the figure, the distance at b_2 c_2 is less than at B_2 C_2, while that at b_3 c_3 is greater than at B_3 C_3; and thus there is a partial compensation in the changes of the effects produced in different points of the orbit. But it can be discovered only by very complete calculations, whether the compensation is perfect or not. The calculations necessary for this purpose are probably the most complicated that physical science has ever given occasion for; and the reader must not here expect the smallest account of them. This only can be stated as a result, that in no instance in the planetary

* These numbers are not quite exact: the proportion of 29 . 72 not being quite accurate.

system is the compensation perfect, and that the chances for its being perfect in any case are infinitely small.

(171.) We have here considered the varying influence of one body on the other at conjunction, as depending entirely on the excentricities of the two orbits. But there is another circumstance which may also cause the influence to vary. The orbits may be inclined, and this will affect both the distance of the bodies and the direction in which they attract each other.

(172.) In the case, then, of Jupiter and Saturn, we have the two planets acting on each other with forces which are nearly the same at every third conjunction, but are not exactly the same, and whose variations occupy a period of 850 years. Of these forces, parts are in the direction of the radius vector, and these tend directly to affect the major axes of the orbit described: other parts are perpendicular to the radius vector, sometimes accelerating and sometimes retarding; and these tend (though in opposite ways) to affect the major axes of the orbits. There are, therefore, forces tending to alter the major axes of the orbits, which go through all their changes only in 850 years. During half of this time they tend to make the major axis of Jupiter's orbit less, and that of Saturn's orbit greater; and during the other half they tend to make the major axis of Jupiter's orbit greater, and that of Saturn's orbit less. This coincidence, in time, of the increase of one major axis with the decrease of the other, is the result of investigations that we cannot explain here.

(173.) After the partial compensation that we have mentioned, it will readily be understood that the varying force which produces these effects is small. So small, indeed, is it, that after acting more than 400 years, it has increased (or diminished) the major axis of Saturn's orbit only by $\frac{1}{1350}$th part, and diminished (or increased) that of Jupiter's orbit only by $\frac{1}{5580}$th part. These alterations would hardly be discoverable with our best instruments. But during 400 years the major axis of each orbit differs from the major axis during the next 400 years by a part of these quantities: the planet's rate of annual angular motion is, for 400 years, constantly less than its average rate; and for the next 400 years it is constantly greater than its average rate: and in this length of time the inequality in longitude may (49.) grow up into a most formidable quantity. In fact, the inequality thus produced in Saturn's longitude amounts to about 48′, by which its true place is sometimes before and sometimes behind its mean place: that in Jupiter's longitude amounts to about 21′. (The greatest inequality of any other planet does not exceed 3′, and the greatest of the planets inferior to Jupiter does not exceed 25″.) The theoretical explanation of these inequalities was first given by Laplace in 1785.

(174.) The magnitude of these inequalities in the motions of Jupiter and Saturn, as we have seen, depends principally on the length of time during which the forces act in the same manner; first, because in this long time they can produce a sensible alteration in the major axis and annual angular motion; secondly, because the two planets move for so long a time with this altered angular motion. But it must also be borne in mind, that these two planets are by far the largest in the system; the mass of Jupiter being 300 times that of the earth, and the mass of Saturn being 100 times that of the earth (the next of the planets in the order of magnitude, except Uranus).

(175.) The same general reasoning, by which we have shown that there is a periodical inequality of the major axis of either of these orbits, will also show that there is a periodical inequality in the excentricity and in the place of the perihelion. It will also appear, in the same way, that these effects are the remainder, after partial compensation of effects in different parts of the orbit. Thus, if one conjunction happen when Jupiter is going towards aphelion, the effect of Saturn's disturbing force is to pull Jupiter from the sun; and therefore, by (59.), to increase the excentricity of Jupiter's orbit. But it is then perfectly certain that either the next conjunction, or the next but one, or perhaps both these, will happen at a part where Jupiter is going towards perihelion; and then, by (59.), the excentricity of Jupiter's orbit is diminished. Similar reasoning applies to the excentricity of Saturn's orbit. It becomes, then, a matter of calculation, whether the compensation is perfect or not. Now it appears, upon investigation, that the compensation is not perfect, but that, while the points of conjunction shift through 120°, the effect of the uncompensated part is, for half the time, to increase the excentricity, and for half the time to diminish it. It appears, also, that there is no necessary connexion between the time at which the excentricity is greatest or least, and that when the major axis is greatest or least; so that we cannot assert that when the major axis is greatest the excentricity is greatest, or the contrary; or that the excentricity of one is greatest when that of the other is greatest: all that we can assert is, that the excentricity of each orbit occupies the same time in going through its changes from greatest to least, as the major axis occupies in going through its change from greatest to least. The effect on the planet's distance from the sun, produced by the change of excentricity, is much more considerable than that from the change in the major axis; being for Jupiter $\frac{1}{1230}$ of his whole distance, and for Saturn $\frac{1}{317}$ of his whole distance.

(176.) Similar remarks apply, in every respect, to the motion of the perihelion of each orbit. Each is made to progress during 425 years, and to regress during 425 years; but there is no necessary relation between the time when one has progressed furthest, and the time when the other has progressed furthest. There is, however, a necessary relation between the change of excentricity and the motion of the perihelion of each orbit: the excentricity of either orbit has its mean value when the perihelion of that orbit has progressed furthest or regressed furthest; and when the excentricity is either greatest or least, the perihelion is at its mean place.

(177.) We have taken the long inequality of Jupiter and Saturn as the most imposing by its magnitude, and the most celebrated for its history (as, before it was explained theoretically, astronomers were completely bewildered by the strange irregularity in the motion of these planets). But there are several others which, in theory, are as curious. Eight times the periodic time of the earth is very nearly equal to thirteen times the periodic time of Venus; and this produces, in the motions of the earth and Venus, a small inequality, which goes through all its changes in 239 years. Four times the periodic time of Mercury is nearly equal to the periodic time of the earth, and this produces an inequality whose period is nearly 7 years. The periodic time of Mars is nearly double of the earth's, and this produces a considerable inequality, depending on the excentricities, &c., besides that mentioned in (159.), which was independent of the excentricities. Twice the periodic time of Venus is nearly equal to five times that of Mercury; three times the periodic time of Venus is nearly equal to that of Mars: three times the periodic time of Saturn does not much differ from that of Uranus. Each of these approximations to equality gives rise to an equation of sensible magnitude, and of long period, in the motion of both planets.

(178.) But it will easily be seen that the defect of compensation, on which the effects depend, is much greater in some cases than in others. The conjunctions of the earth and Mars take place at only one point, and the points near it, for several revolutions: those of Venus and Mars take place only at two opposite points and their neighbourhood, (as each successive conjunction takes place when Mars has described half a revolution, and Venus $1\frac{1}{2}$ revolution); those of Jupiter and Saturn, as we have seen, at three points; those of Venus and the earth at five points. It is evident that, in the first of these, the whole effect of the change of one point of conjunction has its influence in altering the orbit's dimensions; that in the second there is only the difference between two effects; that in the third there is the mixture of three, which tend to balance; that in the next there is the mixture of five in the same way. The smaller, then, is this number of points, the more favourable are the circumstances (supposing the same length of period for the inequality) for producing a large inequality. This number of points is always the same as the difference between the two least numbers, expressing nearly the proportion of the periodic times. Thus we may expect to find a large inequality when the periodic times of two planets are very nearly in the same proportion as two numbers, whose difference is small.

(179.) We shall now proceed to mention the *secular* variations of the elements of the orbits of planets. By this term is meant those variations which do not depend upon the positions of the planets in their orbits, or the places of conjunction, but merely upon their relative distances and excentricities, and the positions of their lines of apses. They are, therefore, the variations which depend upon the

mean or average action of one planet upon another in the long run: all the sensible departures from the secular variation, produced by the irregularity of the action of one planet upon another, being supposed to be contained in the inequalities already discussed.

(180.) First, then, with regard to the mean distance of a planet. If we consider an exterior planet disturbing an interior one, (as Saturn disturbing Jupiter,) the disturbing force in the direction of the radius vector, by (77.), &c., tends sometimes to draw it from the sun, sometimes to draw it towards the sun, but the former is the greater, and we may therefore consider the force as, upon the whole, diminishing the sun's attraction. This, by (46.), alters the relation between the periodic time and the mean distance, so that the mean distance is less than it would have been with the same periodic time, had there been no disturbance. If we consider an interior planet disturbing an exterior one, (as Jupiter disturbing Saturn,) the disturbing force tending to draw it to the sun is greatest; and here the mean distance is greater than it would have been with the same periodic time, had there been no disturbance. But so long as these general effects in the force directed to the sun continue unaltered, the mean distances will not alter (46.), &c. Now, upon taking a very long period, (as several thousand years,) it is easy to see that, if we divide that period into two or three parts, the two planets have in each of those parts been in conjunction indifferently in all parts of their orbits; that they have had every possible relative position in every part; and that (if we make the periods long enough) the force which one planet has sustained in any one point will be accurately the mean of all which it would sustain, if we estimated all those that it could suffer from supposing the other planet to go with its usual motion through the whole of its orbit. As this mean will be the same for each of the periods, there will, in the long run, be no alteration of the force in the direction of the radius vector, and we may assert at once that the mean distance cannot be altered by it.

(181.) But with regard to the disturbing force acting perpendicularly to the radius vector, the circumstances are different. The mere existence of such a force, without variation, causes an alteration in the mean distance (48.); and it is necessary to show that the nature and variations of the force are such that, in the long run, the velocity of the disturbed planet is not affected by it. For this purpose, instead of considering merely the disturbing force perpendicular to the radius vector, we will consider separately the whole force which the disturbing planet exerts on the sun, and the whole force which it exerts on the disturbed planet. Now, the force which it exerts on the sun tends to pull the sun sometimes in one direction and sometimes in another, but, on the whole, produces no permanent displacement: this force, then, may at once be neglected. The force which one planet has exerted on the other has acted when, for any arbitrary position of the disturbing planet, the disturbed planet has been at every point of its orbit. Since the whole acceleration produced in a long time is the sum of all the accelerations diminished by the sum of all the retardations, we may divide them into groups as we please, and sum each group. Let us, then, group together all the accelerations and retardations produced in one position of the disturbing planet. The disturbed planet having been in every small part of its orbit, during a time proportional to the time which it would occupy in passing through that small part in any one revolution, the various accelerations and retardations will bear the same proportion as if the disturbed planet had made one complete revolution, and the disturbing planet had been fixed. Now, it is a well-known theorem of mechanics, that when a body moves through any curve, acted on by the attractions of any fixed bodies, its velocity, when it reaches the point from which it started, is precisely the same as when it started: the accelerations and retardations having exactly balanced. Consequently, in the case before us, if the disturbing planet had been fixed, and the disturbed planet had made one complete revolution, the latter would, on the whole, have been neither accelerated nor retarded; and, therefore, in the long run, all the accelerations and retardations of the disturbed planet, produced in any arbitrary position of the disturbing planet, will exactly balance. The same may be shown for every position of the disturbing planet; and thus, on the whole, there is no alteration of velocity. Since, then, in the long run, the planet's velocity is not altered, and since (180.) the force directed to the sun is not altered, the planet's mean distance will not be altered. This reasoning does not prevent the increase or diminution of the velocity at particular parts of the orbit, and therefore the excentricity and the line of apses may vary; but it shows that, if there is an increase at one part, there is a diminution that balances it at another; and at the point where the orbit at the beginning of a long time, and the orbit at the end of that time intersect, (which will be at mean distance nearly,) the velocity will not be altered.

Our demonstration supposes that the portions of the curves described in different revolutions, for the same position of the disturbing planet, are parts of one orbit, and therefore does not take account of the alteration in the magnitude of the disturbing force produced by the alteration of place which that force has previously caused. This has been taken into account, to a certain degree, by several mathematicians, and it appears, as far as they have gone, that this produces no alteration in the conclusion.

(182.) Secondly, as to the place of perihelion, or the position of the line of apses. The motion of this will depend essentially on the excentricity of the orbit of the disturbing planet. Suppose, for instance, that the orbit of Venus was elliptical and the earth's orbit circular; as the distance of these planets in conjunction is little more than ¼th of the earth's distance from the sun, the ellipticity of the orbit of Venus would bring that planet at aphelion so much nearer to the earth's orbit, that by far the greatest effect would take place when in conjunction there; and this, by (54.), would make Venus' line of apses progress. But if the earth's orbit were more elliptic than that of Venus, and if the earth's perihelion were on the same side of the sun as the perihelion of Venus, it might happen that the principal action would take place at perihelion, and then, by (51.), the line of apses would regress. These effects would continue to go on, while the relative position of the lines of apses, and the proportion of the excentricities, remained nearly the same. As, in the long run, conjunctions would happen everywhere, the preponderating effect would be similar to the greatest effect; and thus, the secular motion of the line of apses will be constant, (till the positions of the lines of apses, &c. shall have changed considerably); its magnitude and direction will depend on the excentricities of both orbits; but if the disturbed planet is the interior, and if the orbit of the other be not excentric, the line of apses will progress. The same is true, if the disturbed planet is exterior (the greatest action being then at the perihelion, if the interior orbit have no excentricity, and being directed to the sun).

(183.) Thirdly, as to the excentricity. If the orbit of the disturbing planet were circular, the effect on the excentricity produced by conjunction at the place where the orbits are nearest, would be of one kind before conjunction, and of the opposite kind after conjunction, from the disturbing force in the radius vector, as well as from that perpendicular to the radius vector; and thus the excentricity would not be altered. The same would happen if both orbits were excentric, provided their lines of apses coincided. Thus it appears that there is no variation of excentricity, except the orbit of the disturbing planet is excentric, and its line of apses does not coincide with that of the disturbed planet. When these conditions hold, (as they do in every planetary orbit,) a general idea of the effect may be obtained by finding where the orbits approach nearest; then, if we consider the disturbance of the interior planet, since the force draws it from the sun, the excentricity will be increased if it is moving from perihelion, or diminished if it is moving towards perihelion. For the exterior planet, as the force draws it towards the sun, the conclusion will be of the opposite kind. These effects are constant, till the excentricities and the positions of the lines of apses have changed sensibly. The place where the force at conjunction produces the greatest effect on the excentricity may not be strictly the place where the orbits are nearest, but probably will not be far removed from that place.

At the place where the orbits approach nearest, both planets in general are moving from perihelion, or both towards perihelion, so that when one excentricity is increased, the other is diminished.

(184.) For the general stability of the planetary system, the positions of the lines of apses are not important, but the permanency of the major axes and the excentricities are of the greatest importance. The conclusion which we have mentioned as to the absence of secular variation of

the major axis, from the action of one planet, applies also to the disturbances produced by any number of planets, and thus we can assert that the major axes of the orbits of the planets are not subject to any secular variation. The excentricities are subject to secular variation, but even this corrects itself in a very long time: when the investigation is fully pursued, it is found that each of the excentricities is expressed by a number of periodic terms, the period of each being many thousands of years. Thus the major axis of the earth's orbit, notwithstanding its small and frequent variations, has not sensibly altered in many thousands of years, and will not sensibly alter; the excentricity, besides suffering many small variations, has steadily diminished for many thousands of years, and will diminish for thousands of years longer, after which it will again increase.

(185.) A remarkable relation exists between the variation of the excentricities, (of which that mentioned in (183.) is a simple instance,) the result of which, as to the state of the excentricities at any time, is given thus:—The sum of the products of the square of each excentricity by the mass of the planet, and by the square root of the major axis, is always the same.

SECTION VIII.—*Perturbation of Inclination and Place of Node.*

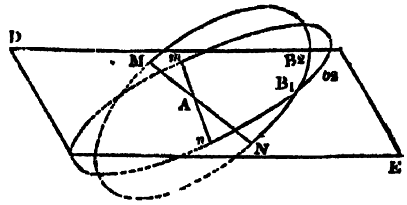
(186.) We have hitherto proceeded as if the sun, the moon, and all the planets, revolved in the same plane—as if, for instance, the sun were fixed in the centre of a table, and all the planets, with their satellites, revolved on the surface of the table. But this supposition is not true. If we suppose the earth to revolve on the surface of the table, the moon will, in half her revolution, (we mean while she describes 180°, not necessarily in half her periodic time,) rise above the table, and in the other half she will go below it, crossing the surface at two points which, as seen from the earth, are exactly opposite. Venus will, in half her revolution, rise above the table, and in half will sink below it, crossing the table at two points which, as seen from the sun, are exactly opposite; each of the other planets and satellites in like manner crosses the plane at points which, as seen from the central body, are exactly opposite. In different investigations it is necessary to consider the inclination of the plane of revolution or the plane of the orbit to different planes of reference: the line in which the plane of revolution crosses the plane of reference is called the *line of nodes on that plane;* and the angle which the plane of revolution makes with the plane of reference is called the *inclination to that plane.* The plane of reference must always be supposed to pass through the central body.

(187.) The inclinations of all the orbits, except those of the small planets, are so trifling, (the largest—namely, that of the moon's orbit to the earth's orbit—being, at its mean state, only 5°,) that they may in general be wholly neglected in estimating the disturbance which one planet produces in the motion of another in its own plane. In some cases however, as in the inequalities of long period, where the effective force is only the small part which remains after a compensation more or less perfect, no alteration of the forces must be neglected; and here, as we have hinted in (171.), the inclinations must be taken into account.

(188.) But though the alteration which the inclination produces in the forces that tend to disturb the body's motion *in* its plane may, in most cases, be neglected, yet the force which tends to pull the body *above* the plane, or *below* the plane, cannot be neglected. In almost every case this force will be less than the force tending to disturb the motion in the plane, yet it will be much greater than the alteration which the inclination produces in that force. It is our object in this section to show the nature of the alteration which is produced by the force tending to pull the body from the plane.

(189.) First, then, as to the effect of a force generally which acts perpendicularly to the plane of revolution. (We shall confine ourselves at present to forces which act perpendicularly to the plane, because it is evident that forces which act in, or parallel to, the plane of the orbit, whether in the radius vector or perpendicularly to it, will not cause the planet to depart from that plane.) Let *fig.* 40 be a perspective representation of an orbit, and a plane of reference. Suppose M A N to be the line of nodes at which the plane of the orbit N B_1 B_2 crosses the plane of reference D E; the central body A being in the line of nodes, and

Fig. 40.

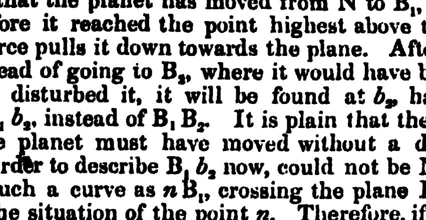


the part of the orbit marked by a dark line being above the plane, and that marked by a dotted line being below it. Suppose that the planet has moved from N to B_1, and that at B_1, before it reached the point highest above the plane D E, a force pulls it down towards the plane. After a short time, instead of going to B_2, where it would have been if no force had disturbed it, it will be found at b_2, having described B_1 b_2, instead of B_1 B_2. It is plain that the orbit in which the planet must have moved without a disturbing force, in order to describe B_1 b_2 now, could not be N B_1, but must be such a curve as n B_1, crossing the plane D E at a point in the situation of the point n. Therefore, if no more disturbing forces act, the planet, which has described B_1 b_2 as if it came without disturbance from n, will go on to describe an orbit as if it had come without disturbance from n, and will therefore describe an orbit n B_1 b_2 m, crossing the plane E F in the points n and m. The line of nodes is changed from M A N to m A n.

(190.) Here the line of nodes has twisted in a direction opposite to the planet's motion, or has *regressed.* The inclination of the new plane is evidently less than that of the old one, since it passes through the same point B, and cuts the plane of reference in a line more distant from B than the line in which the old one cut it, or the inclination is *diminished.*

(191.) Now, if we conceive that at B_3, *fig.* 41, after the planet has passed the point highest above the plane, a force tends to pull it towards the plane, the planet, instead of going to B_4, will go to b_4, and instead of crossing the plane

Fig. 41.



D E at M, will cross it at m; and then, if it is not disturbed again, will proceed in an orbit of which B_3 b_4 m is a part, and which will cross the plane D E at the points m and n. The new line of nodes has twisted here also in the direction opposite to the direction of the planet's motion, or has *regressed.* But the inclination of the new plane is greater than that of the old one, since it passes through the same point B_3, and cuts the plane of reference in a line less distant from B_3 than the line in which the old one cut it, or the inclination is *increased.*

(192.) We have, then, this general result: If a force acting perpendicularly to the orbit tends to draw the planet towards the plane of reference, it always causes the line of nodes on that plane to regress: while the planet is moving from a node to the point highest above the plane of reference, it diminishes the inclination to that plane; and while the planet is moving from the highest point to a node, it increases the inclination.

(193.) In the same manner, if the force tends to draw the planet from the plane of reference, it always causes the line of nodes to progress. While the planet is moving from a node to the point highest above the plane, it increases the inclination; and while the planet is moving from the highest point to a node, it diminishes the inclination.

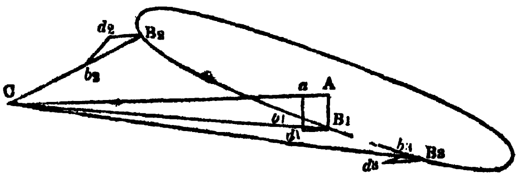
(194.) Similar results would have been obtained if we had considered the action of the force while the planet is in that part of its orbit which is on the other side of the plane D E.

We shall now proceed with the consideration of the force perpendicular to the orbit, which is produced by the attraction of a disturbing body.

(195.) First: it is plain that, if the disturbing body is in the plane of the orbit (produced, if necessary), it will not tend to draw either the central body or the planet out of

that plane, and therefore will produce no disturbing force perpendicular to the plane of the orbit. Proceeding, then, with the supposition that the disturbing body is not in the plane of the orbit; and supposing *fig.* 42 to be a perspective view of an orbit B_2 B_1 B_3 (which, to assist our ideas, may be conceived to differ little from a circle) with the disturbing body C out of the plane of the orbit, let us take

Fig. 42.



three points B_1 B_2 B_3, of which B_1 is at the same distance as A from C, B_2 is nearer to C, and B_3 farther from C than A is. Suppose that the attraction of C draws A in a certain small time through the space Aa, and that when the planet is at B_1, or B_2, or B_3, the attraction draws the planet in the same time through B_1 b_1, or B_2 b_2, or B_3 b_3 respectively. Then (as in (71.)) the attraction of C upon the two bodies A and B would produce no disturbance in their relative motions, if it drew them through equal spaces in the same direction. Draw B_1 d_1, B_2 d_2, B_3 d_3 each equal and parallel to Aa; then if the attraction had drawn B_1 to d_1, there would have been no disturbance, and consequently the real disturbance at B_1 is represented by a force which would have drawn the planet from d_1 to b_1. Similarly, the real disturbances at B_2 and B_3 are represented by forces which would have drawn the planet from d_2 to b_2, and from d_3 to b_3 respectively. Now, since CB_1 is equal to C A, the forces of C upon A and B_1 are equal, and therefore B_1 b_1 is equal to Aa, and therefore a b_1 is parallel to A B_1, and therefore is in the same straight line with b_1 d_1; and consequently at B_1 the whole disturbing force is parallel to the radius vector, and there is no part perpendicular to the plane of the orbit. But at B_2 the planet is nearer to C, the force therefore on the planet is greater, and B_2 b_2 is therefore greater than Aa or B_2 d_2; also it is more nearly perpendicular to the plane of the orbit than B_2 d_2; and consequently b_2 is farther from the plane of the orbit than d_2; and therefore the disturbing force d_2 b_2 is directed from the plane of the orbit towards the side on which C is. On the contrary, at B_3 the planet is farther from C; the force on the planet is therefore less: and B_3 b_3 is therefore less than Aa or $B_3$$d_3$; moreover it is inclined more to the perpendicular than B_3 d_3, and consequently b_3 is nearer to the plane of the orbit than d_3; and therefore the disturbing force d_3 b_3 is directed from the side on which C is. Thus we find,

(196.) When the central and revolving bodies are equally distant from the disturbing body, there is no disturbing force perpendicular to the plane of the orbit.

(197.) When the revolving body is nearer the disturbing body than the central body is, the disturbing force perpendicular to the plane tends to draw the revolving body out of the plane to that side on which the disturbing body is.

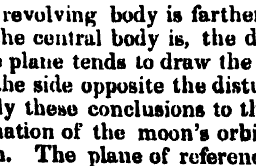
(198.) When the revolving body is farther from the disturbing body than the central body is, the disturbing force perpendicular to the plane tends to draw the revolving body out of the plane to the side opposite the disturbing body.

We may now apply these conclusions to the alteration of the node and inclination of the moon's orbit produced by the sun's attraction. The plane of reference is here supposed to be the plane of the earth's orbit.

(199.) First: suppose the line of nodes of the moon's orbit to be in syzygies, or to pass through the sun. Here the sun is in the moon's orbit produced, and therefore, by (189.), there is no disturbing force perpendicular to the moon's orbit.

(200.) Secondly: suppose the line of nodes to be in quadratures, or to be perpendicular to the line drawn from the

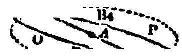
Fig. 43.



earth to the sun, as in *fig.* 43. The sun, in the figure, may be considered as being below the plane of the moon's orbit. Also, the moon's distance from the earth being small, the points, at which the moon's distance from the sun is the same as the earth's, are very nearly the same as the points of quadrature, or (in the case before us) they are very nearly the same as the nodes. Consequently, while the moon moves from B_4 through B_1 to B_2, she is nearer to the sun than the earth is, and therefore the disturbing force, by (197.), tends to pull her downwards from the plane of her orbit: while the moon moves from B_2, through B_3, to B_4, she is farther from the sun than the earth is, and therefore the disturbing force tends to pull her upwards from the plane of her orbit. In the case before us, then, the disturbing force is always directed towards the plane of reference. Consequently, by (192.), while the moon moves from B_4 to B_1, the line of nodes is made to regress, and the inclination is diminished; while the moon moves from B_1 to B_2, the line of nodes regresses, and the inclination is increased; while the moon moves from B_2 to B_3, the line of nodes regresses, and the inclination is diminished: and while the moon moves from B_3 to B_4, the line of nodes regresses, and the inclination is increased. The inclination, therefore, is not sensibly altered in a whole revolution, but the line of nodes regresses during the whole of the revolution.

(201.) Thirdly: suppose the line of nodes to be in such a position that the moon passes the line of nodes in going from quadrature to syzygy, as in *fig.* 44. Here the sun is to be considered as below the moon's orbit, and, therefore, while the moon moves from B_4, through B_1, to B_2, the dis-

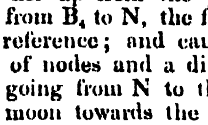
Fig. 44.



turbing force tends to pull her down from the plane of the orbit, and while she moves from B_2, through B_3, to B_4, the force tends to pull her up from the plane of her orbit. Therefore, in going from B_4 to N, the force pulls the moon from the plane of reference; and causes thereby a progression of the line of nodes and a diminution of the inclination (193.); in going from N to the highest point O, the force pulls the moon towards the plane of reference; and, therefore, causes the nodes to regress, and the inclination to diminish (192.); in going from the highest point O to B_2, the force still pulls the moon towards the plane of reference; and, therefore, still causes the nodes to regress, but causes the inclination to increase. Thus while the moon moves from B_4 to N, the force causes the line of nodes to progress, and while she moves from N to B_2, it causes the line of nodes to regress; and, similarly, while she moves from B_2 to M, the force causes the line of nodes to progress; and while she moves from M to B_4, it causes the line of nodes to regress. On the whole, therefore, the line of nodes regresses, but not so rapidly as in the second case. Also, while the moon moves from B_4 to O the inclination is diminished, and while she moves from O to B_2 the inclination is increased; and, similarly, while she moves from B_2 to P the inclination is diminished; and while she moves from P to B_4 the inclination is increased. On the whole, therefore, the inclination is diminished.

(202.) Fourthly: suppose the line of nodes to be in such a position that the moon passes it in going from syzygy to quadrature, as in *fig.* 45. Here, also, the sun is below the

Fig. 45.



plane of the orbit produced; and, therefore, from B_4 to B_2 the force tends to pull the moon down from her orbit; and from B_2 to B_4 it tends to pull her up from it. As in the last case it would be seen, that while the moon moves from B_4 to M, the line of nodes regresses; while from M to B_2, the line of nodes progresses; while from B_2 to N, the line of nodes regresses; and while from N to B_4, the line of nodes progresses. On the whole, therefore, the line of nodes regresses. Also, it will be seen, that while the moon moves from B_4 to O, the inclination is diminished; while from O to B_2, the inclination is increased; while from B_2 to P, the inclination is diminished; and while from P to B_4, the inclination is increased. On the whole, therefore, the inclination is increased.

The same reasoning would apply, and lead to the same

conclusions in every respect, if we supposed the moon's orbit inclined in the opposite direction.

(203.) Now the earth moves round the sun, and, therefore, the sun appears to move round the earth, in the same direction in which the moon moves round the earth. If then we begin with the state in which the line of nodes is passing through the sun (and in which neither the node nor the inclination undergoes any change, by the first case), we come next to the state in which the moon passes the line of nodes in going from quadrature to syzygy (in which the node regresses and the inclination diminishes, by the third case); then we come to the state in which the line of nodes coincides with the line of quadratures (in which the node regresses rapidly, and the inclination is not altered, by the second case); then we come to the state in which the moon passes the line of nodes in going from syzygy to quadrature (in which the node regresses and the inclination is increased, by the fourth case); and then we come to the state in which the line of nodes again passes through the sun. This is when the sun has described, apparently, half a revolution round the earth (or rather less, in consequence of the regression of the node), and in the other half revolution, the same changes in every respect take place in the same order. The inclination, therefore, is greatest when the line of nodes passes through the sun, or coincides with the line of syzygy; and is least when the line of nodes coincides with the line of quadratures; since it is constantly diminishing while we are going from the former state to the latter, and constantly increasing while we are going from the latter state to the former. This is the principal irregularity in the inclination of the moon's orbit; all the others are very small.

(204.) The line of nodes is constantly regressing at every revolution of the moon, except when the line of nodes passes through the sun. The annual motion which we might at first expect it to have is somewhat diminished by the circumstance that the rapid regression of the line of nodes, when in the position in which the greatest effect is produced, carries it from the line of quadratures more swiftly than the sun's progressive motion only, by making the line of quadratures to progress, would separate them. But as the line of nodes never progresses, the diminution of the motion of the line of nodes thus occasioned is very much less than the increase of the motion of the line of apses. (107.) Also, as the force acting on opposite points of the orbit tends to produce effects of the same kind, there is no irregularity similar to that explained in (106.). Hence the actual regression of the line of nodes, though a little less than might at first be expected, differs from that regression by a much smaller quantity than that by which the actual motion of the line of apses differs from the motion which at first we might expect it to have. The line of nodes revolves completely round in something more than nineteen years.

(205.) The effect of the irregularity in the regression of the nodes, and the effect of the alternate increase and diminution of the inclination, are blended into one inequality of latitude, which depends on the sun's longitude, the longitude of the moon's node, and the moon's longitude. This inequality was discovered (from observation) by Tycho Brahé, about A.D. 1590. It may be considered to bear the same relation to the inclination which the evection bears to the excentricity; and, like the evection in longitude, it is the greatest of the inequalities in latitude. It is however much less than the evection; its greatest effect on the moon's latitude being about 8′, by which the mean inclination is sometimes increased and sometimes diminished.

(206.) There are other small inequalities in the moon's latitude, arising partly from the changes in the node and inclination, which take place several times in the course of each revolution (200.), &c.; partly from the excentricity of the orbits of the moon and the earth, partly from the distortion accompanying the *variation*, and partly from the variability of the inclination itself. We shall not however delay ourselves with the explanation of all these terms.

(207.) We shall now proceed with the disturbance of the planets in latitude.

In this inquiry it is always best to take the orbit of the disturbing planet for the plane of reference. Now let us first consider the case of Mercury or Venus disturbed by Jupiter. In this case Jupiter revolving in a long time round the sun, which is the central body to Mercury or Venus, produces exactly the same effect as the sun revolving (or appearing to revolve) round the earth, which is the central body to the moon. The disturbing force of Jupiter therefore produces a regression of the nodes of the orbits of Mercury and Venus on Jupiter's orbit; and an irregularity in the motion of each node, and an alteration in the inclination, whose effects might be combined into one: and this is the only inequality in their latitude, produced by Jupiter, whose effects are sensible.

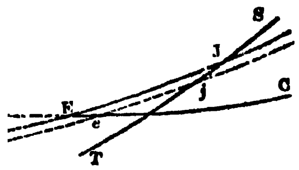
(208.) The other inequalities in latitude, depending on the relative position of the planets, possess no particular interest; and a general notion of them may be formed from the remarks in the discussion of the motion of the moon's node. One case however may be easily understood. When an exterior planet is disturbed by the attraction of an interior planet, whose distance from the sun is less than half the distance of the exterior planet, and whose periodic time is much shorter, then the exterior planet is always further from the interior planet than the sun is; and therefore, by (195.), there is a disturbing force urging it from the plane of reference when the planets are in conjunction, and to it when they are in opposition; and thus the exterior planet is pushed up and down for every conjunction of the two planets. The disturbance however is nothing when the exterior planet is at the line of its nodes (195.).

(209.) The near commensurability of periodic times, which so strikingly affects the major axis, the excentricity, and the place of perihelion, produces also considerable effects on the node and the inclination. The reasoning of (175.) and (176.) will in every respect apply to this case; the greatest effect is produced, both on the motion of the node and on the change of inclination, when the planets are in conjunction: the gradual alteration of the point of conjunction produces a gradual alteration of these effects, which however (in such a case as that of Jupiter and Saturn) is partially counteracted by the gradual change of the other points of conjunction: the uncompensated part however may, in many years, produce a very sensible irregularity in the elements. If we put the words *line of nodes* for *line of apses*, and *inclination* for *excentricity*, the whole of the reasoning in (175.), &c., will apply almost without alteration.

(210.) For the secular variation of the position of the orbit, the following considerations seem sufficient. In the long run the disturbed planet has been at every one point of its orbit a great number of times, while the disturbing planet has been at almost every part of its orbit. The disturbing force is always the difference of the forces which act on the sun and on the disturbed planet. As the disturbing planet, in these various positions, acts upon the sun in all directions in the plane of its orbit, its effect on the sun may be wholly neglected; and then it is easy to see that, whether the disturbing planet be exterior or interior to the other, the combined effect of the forces in all these points on the disturbed planet at one point is to pull it from its orbit towards the plane of the disturbing planet's orbit. (This depends upon the circumstance that the force is greatest when the disturbing planet is nearest.) Consequently, by (192.), the line of nodes of the disturbed planet's orbit on the disturbing planet's orbit, in the long run, always regresses. If the orbits are circular, there is no alteration of the inclination, since, at points equally distant from the highest point, there is the same force on the disturbed planet; and therefore, by (192.), the inclination is increased at one time, and diminished as much at another. If the orbits are elliptic, one point may be found where the effect of the force on the inclination is greater than at any other, and the whole effect on the inclination will be similar to that.

(211.) In stating that the nodes always regress in the long run, the reader must be careful to restrict this expression to the sense of regressing on the orbit of the disturbing planet. It may happen that on another orbit they will appear to progress. Thus the nodes of Jupiter's orbit are made to regress on Saturn's orbit by Saturn's disturbing force. The nodes of these orbits on the earth's orbit are not very widely separated; but the inclination of Saturn's orbit is greater than that of Jupiter's If we trace these on a celestial globe, we shall have such a figure as *fig.* 46, where E C represents the plane of the earth's orbit, J E the orbit of Jupiter, and S T that of Saturn. The orbit of Jupiter, by regressing on Saturn's orbit, assumes the position of the dotted line *j e*; but it is plain that the intersection of this orbit with the earth's orbit has gone in the opposite

Fig. 46



direction, or has progressed. If the motion of the node on Saturn's orbit from J to *j* is regression, the motion of the node on the earth's orbit from E to *e* must be progression.

(212.) There is a remarkable relation between the inclinations of all the orbits of the planetary system to a fixed plane, existing through all their secular variations, similar to that between their excentricities. The sum of the products of each mass, by the square root of the major axis of its orbit, and by the square of the inclination to a fixed plane, is invariable.

(213.) The disturbance of Jupiter's satellites in latitude presents circumstances not less worthy of remark than the disturbance in longitude. The masses are so small, and their orbits so little inclined to each other, that the small inequalities produced in a revolution may be neglected. Even that depending on the slow revolution of the line of conjunctions of the first three satellites, so small is the mutual inclination of their orbits, does not amount to a sensible quantity. We shall therefore consider only those alterations in the position of the planes of the orbits which do not vary sensibly in a small number of revolutions. For this purpose we must introduce a term which has not been introduced before.

(214.) If the moon revolved round the earth in the same plane in which the earth revolves round the sun, the sun's attraction would never tend to draw the moon out of that plane. But (taking the circumstances as they really exist,) the moon revolves round the earth in a plane inclined to the plane in which the earth revolves round the sun; and the consequence, as we have seen, is, that the line of nodes upon the latter plane regresses, and the inclination of the orbit to the latter plane remains, on the whole, unaltered. The plane of the earth's orbit, then, may be considered a *fundamental plane* to the moon's motion; by which term we mean to express, that if the moon moved in that plane, the disturbing force would never draw her out of it; and that if she moved in an orbit inclined to it, the orbit would always be inclined at nearly the same angle to that plane, though its line of nodes had sensibly altered. The latter condition will, in general, be a consequence of the former.

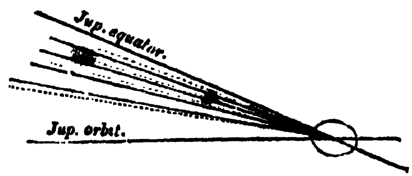
(215.) In order to discover what will be the fundamental plane for one of Jupiter's satellites, we must consider that, besides the sun's attraction, there is another and more powerful disturbing force acting on these bodies, namely, the irregularity of attraction produced by Jupiter's flatness. The effect of this (as we shall show) is always to pull the satellites towards the plane of Jupiter's equator. If Jupiter were spherical, the only disturbing force would be the sun's attraction, tending on the whole to draw the satellite towards the plane of Jupiter's orbit, and that plane would be the fundamental plane of the satellite. If Jupiter were flattened, and if the sun did not disturb the satellite, the irregularity in Jupiter's shape would always tend to draw the satellite towards the plane of his equator, and the plane of his equator would be the fundamental plane of the satellite. As both causes exist, the position of the actual fundamental plane must be found by the following consideration. We must discover the position of a plane from which the sun's disturbing force tends, on the whole, to draw the satellite downwards, and the disturbing force depending upon Jupiter's shape tends to draw it upwards (or *vice versâ*), by equal quantities; and that plane will be the fundamental plane. This plane must lie *between* the planes of Jupiter's orbit and Jupiter's equator, because thus only can the disturbing forces act in opposite ways, and therefore balance each other: and it must pass through their intersection, as otherwise it would at that part be above both or below both, and the forces depending on both causes would act the same way.

(216.) The disturbing force of the sun, as we have seen (82.), &c., is greater as the satellite is more distant; the disturbing force depending on Jupiter's shape is then less, as we shall mention hereafter. Consequently, as the satellite is more distant, the effect of the sun's disturbing force is much greater in proportion to that depending on Jupiter's shape Thus, if there were a single satellite at the distance of Jupiter's first satellite, its fundamental plane would nearly coincide with the plane of Jupiter's equator; if at the distance of Jupiter's second satellite, its fundamental plane would depart a little farther from coincidence with the plane of the equator; and so on for other distances; and if the distance were very great, it would nearly coincide with the plane of Jupiter's orbit. If, then, Jupiter's four satellites did not disturb each other, each of them would have a separate fundamental plane, and the positions of these planes would depend only upon each satellite's distance from Jupiter.

(217.) In fact, the satellites do disturb each other. In speaking of the planets (210.), we have observed that the effect of the attraction of one planet upon another, in the long run, is to exert a disturbing force tending to draw that other planet (at any part of its orbit) towards the plane of the first planet's orbit. The same thing is true of Jupiter's satellites. Now, though each of them moves generally in an orbit inclined to its fundamental plane, yet in the long run (when the nodes of the orbit have regressed many times round), we may consider the motion of each satellite as taking place in its fundamental plane. The question, therefore, must now be stated thus. The four satellites are revolving in four different fundamental planes; and the position of each of these planes is to be determined by the consideration that the satellite in that plane is drawn towards the plane of Jupiter's orbit by the sun's disturbing force, towards the plane of Jupiter's equator by the force depending on Jupiter's shape, and towards the plane of each of the other three satellites, by the disturbing force produced by each satellite: and these forces must balance in the long run.

(218.) The determination of these planes is not very difficult, when general algebraical expressions have been investigated for the magnitude of each of the forces. The general nature of the results will be easily seen; the several fundamental planes will be drawn nearer together (that of the first satellite, that of the second, and that of the third, will be drawn nearer to Jupiter's orbit, while that of the fourth will be drawn nearer to Jupiter's equator). The four planes wil still pass through the intersection of the plane of Jupiter's equator with that of Jupiter's orbit. Thus, if we conceive the eye to be placed at a great distance, in the intersection of the planes of Jupiter's orbit and Jupiter's equator, and if the dotted lines in *fig.* 47 represent the ap-

Fig. 47.



pearance of the fundamental planes which would exist if the satellites did not disturb each other, then the dark lines will represent the positions of these planes as affected by the mutual disturbances. The inclination of Jupiter's equator to Jupiter's orbit is about 3° 5′; and so great is the effect of his shape, that the fundamental plane of the first satellite is inclined to his equator by only 7″; that of the second satellite by about 1′; that of the third by about 5′; and that of the fourth by about 24½′. Without mutual perturbation, the inclinations to Jupiter's equator would have been about 2″, 20″, 4′, and 48′.

(219.) Having considered the positions of the fundamental planes, we shall now consider the motion of a satellite, when moving in an orbit inclined to its fundamental plane.

(220.) The general effect will be of the same kind as that for the moon. Since the disturbing force which then tends to pull it from the plane of its orbit, tends to pull it towards the fundamental plane (as, supposing the satellite to be on that side of the fundamental plane next the plane of Jupiter's equator, the sun's disturbing force towards Jupiter's orbit is increased, that towards Jupiter's equator is diminished, and so for the others), the line of nodes will regress on the fundamental plane. The inclination on the whole will not be altered. That part of the regression of the nodes which depends on the sun's disturbing force will be greater for the distant satellites than for the near ones; but that which depends on the shape of Jupiter (and which is much more important) will be greater for the near satellites than for the distant ones. On the whole, therefore, the lines

of nodes of the interior satellites will regress more rapidly than those of the exterior ones. Their annual regressions (beginning with the second) are, in fact, 12°, 2°, 32′, and 41′.

(221.) But the disturbing force of one satellite upon the others will be altered by the circumstance of its orbit not coinciding with its fundamental plane; and the orbit remains long enough in nearly the same position to produce a very sensible irregularity. To discover the nature of this, we must observe that the force of one satellite, perpendicular to the orbit of another, depends wholly upon the inclination of the two orbits, so that, upon increasing the inclination, the disturbing force is affected. Suppose now, to fix our ideas, the second satellite moves in an orbit inclined to its fundamental plane; what is the kind of disturbance that it will produce in the latitude of the first satellite? First, it must be observed, that when moving in the fundamental planes, the forces depending upon the inclination of those planes were taken into account in determining the position of those planes; so that here we have to consider only the alteration produced by the alteration in the second satellite's place. Next, we shall proceed in the same manner as in several preceding instances, by finding what is the motion of the first satellite, related to the motion of the second satellite, which can exist permanently with this inclination of the second satellite. Now, in whatever part the actual orbit of the second is higher above, or less depressed below, the orbit of the first, than the fundamental plane of the second was, at that part there will be a greater force drawing the first satellite up, or a smaller force drawing it down, (in the conjunctions at that part,) than before. The alteration of force, then, will be generally represented by supposing a force to act on the first satellite, at different points of its orbit, towards the same side of its orbit as the side on which the second satellite's orbit is there removed from its fundamental plane, and proportional to the magnitude of that removal. Now, conceiving the inequality introduced into the motion of the first satellite to be a small inclination of its orbit to its fundamental plane, (which is the only inequality of Jupiter's satellites that we consider,) the nodes of this orbit cannot correspond to the places where the second satellite is furthest from its fundamental plane; for then, at one node of the first satellite, the disturbing force, before and after passing that node, being great, and not changing its direction, would not alter the place of the node, but would greatly alter the inclination: and at the opposite node, the force acting in the opposite direction would produce the same effect; and thus the permanency of the inequality would be destroyed. We must then suppose the nodes of the orbit of the first satellite on its fundamental plane to coincide with those of the orbit of the second satellite on its fundamental plane. But is the inclination to be the same way, or the opposite way? To answer this, we must consider that the action of Jupiter's shape would tend to make the nodes of the first satellite regress much more rapidly than those of the second; but as our orbit of the first satellite is assumed to accompany the second in its revolution, the disturbing force depending on the second must be such as to destroy a part of this regression, or to produce (separately) a progression of the nodes of the first; consequently, the disturbing force produced by the second must tend to draw the first from its fundamental plane. (193.) But the disturbing force produced by the second is in the same direction as the distance of the second from the fundamental plane of the second; consequently, the orbit of the first must lie in the same position, with regard to the fundamental plane of the first, in which the orbit of the second lies with regard to the fundamental plane of the second. The same reasoning applies to every other case of an interior satellite disturbed by an exterior; and thus we have the conclusion: If the orbit of one of Jupiter's satellites is inclined to its fundamental plane, it affects the orbit of each of the satellites interior to it with an inclination of the same kind, and with the same nodes.

(222.) Let us now inquire what will be the nature of the inequality produced in the latitude of the third satellite. The same reasoning and the same words may, in every part, be adopted, except that the regression of the nodes of the third satellite, as produced by Jupiter's shape, will be slower than that of the second satellite, and therefore the disturbing force which acts on the third must now be such as to quicken the regression of its nodes, and must therefore be directed towards its fundamental plane. From this consideration we find, as a general conclusion, if the orbit of one of Jupiter's satellites is inclined to its fundamental plane, it affects the orbit of each of the satellites exterior to it, with an inclination of the opposite kind, but with the same nodes.

(223.) The first satellite's orbit appears to have no sensible inclination to its fundamental plane; but those of the second, third, and fourth are inclined to their fundamental planes, (the second 25′, and the third and fourth about 12′,) and these are found to produce in the others inequalities such as we have investigated.

(224.) It is only necessary to add, that the disturbance of the first satellite by the second produces an alteration in the action of the first on the second, tending to draw the second from its fundamental plane, and therefore to diminish, by a small quantity, the regression of its nodes. In the same manner, the altered action of the third on the second tends to draw the second towards its fundamental plane, and therefore to increase, by a small quantity, the regression of its nodes. There is exactly the same kind of complication with regard to the disturbances of these bodies in latitude as with regard to those in longitude, explained in (150.), &c.

(225.) The only other inequality in latitude, which is sensible, is that depending on the position of the sun, with regard to the nodes of the orbits on the plane of Jupiter's orbit, (that is, with regard to the node of Jupiter's equator on Jupiter's orbit,) and this amounts to only a few seconds. It is exactly analogous to that of the moon, explained in (205.).

Section IX.—*Effects of the Oblateness of Planets upon the Motions of their Satellites.*

(226.) In the investigations of motion about a central body, we have supposed that central body to be a spherical ball. This makes the investigation remarkably simple; for it is demonstrated by mathematicians, that the spherical form possesses the following property: the attraction of all the matter in a sphere upon another body at any distance external to it is exactly the same as if all the matter of the sphere were collected at the centre of the sphere. In the investigation of motion about a centre, we may therefore lay aside (as we have usually done) all consideration of the size of the attracting body, if that body is spherical.

(227.) But the planets are not spherical. Whether or not they have ever been fluid, still they have (at least, the earth has) a great extent of fluid on its surface, and the form of this fluid will be affected by the rotation of the planet. The fluid will spread out most where the whirling motion is most rapid, that is, at the equator. Thus it appears from theory, and it is also found from measures, that the earth is not a sphere, but a spheroid, flattened at the north and south poles, and protuberant at the equator. The proportion of the axes differs little from the proportion of 299 : 300; so that a line drawn through the earth's centre, and passing through the equator, is longer than one passing through the poles, by 27 miles.

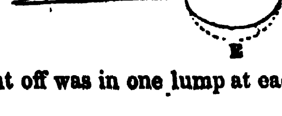
(228.) The flattening of Jupiter is still more remarkable. The proportion of his axes differs little from that of 13 : 14, and thus the difference of his diameters is nearly 6000 miles. In fact, the eye is immediately caught by the elliptic appearance of Jupiter, on viewing him for a moment in a telescope.

(229.) It is our business, in the present section, to point out the general effects of this shape upon the motion of satellites. The agreement of observation with calculation on this point is certainly one of the most striking proofs of the correctness of the theory, 'that every particle of matter attracts every other particle, according to the law of Universal Gravitation.'

(230.) We will begin with explaining the law according to which an oblate planet attracts a satellite in the plane of its equator.

The spheroid represented by the dark line in *fig.* 48 may be supposed to be formed from the sphere represented by the dotted line, by cutting off a quantity of matter from each pole. To simplify our conception, let us suppose that

Fig. 48.



all the matter cut off was in one lump at each pole; that is

at the points D and E. The attraction of the whole sphere on the satellite B, as we have remarked, is the same as if all the matter of the sphere were collected at A. But the attraction of the part cut off is not the same as if it were collected at A, inasmuch as its distance from B is greater, and as the direction of the attraction to D, or to E, is not the same as that to A. Thus, suppose A D is called 1, and A B is called 10. Since the forces are inversely as the squares of the distances at which the attracting mass is situate, the attraction of the lump D, if at the point A, where its distance from B is 10, may be called $\frac{1}{100}$; but if at D, it must be called $\frac{1}{101}$, since the square of B D is equal to the sum of the squares of B A and A D, that is, to the sum of 100 and 1. Also the direction of attraction is not the same; for, if the attraction of D should draw the satellite through B b, and if $b c$ be drawn perpendicular to A B, the only effective approach to A is the distance B c, which is less than B b in the proportion of B A to B D, or of 10 to $\sqrt{101}$; and, therefore, the effective attraction of D, estimated by the space through which it draws the satellite towards A, must be called $\frac{10}{101 \times \sqrt{101}}$. And this is the whole effect which its attraction produces; for though the attraction of D alone tends to draw the satellite above A B, yet the attraction of E will tend to draw it as much below A B; and thus the parts of the force which act perpendicular to A B will destroy each other. We have, then: the attraction of the lump D, if placed at A, would be represented by $\frac{1}{100} = 0{\cdot}01$; but as placed at D, its effective attraction is represented by $\frac{10}{101 \times \sqrt{101}} = 0{\cdot}0098518$. The difference is $0{\cdot}0001482$, or nearly $\frac{1500}{100000}$th of the whole attraction of D, and the same for E. Consequently, the lumps at D and E produce a smaller effective attraction on B than if they were collected at A; but the whole sphere produces the same effect as if its whole mass were collected at A; and, therefore, the part left after cutting away the lumps at D and E produces a greater attraction than if its whole mass were collected at A.

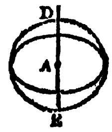
(231.) But it is important to inquire, whether this attraction is greater than if the matter of the spheroid were collected at the centre in the same proportion at all distances of the satellite. For this purpose, suppose the distance of the satellite to be 20. The same reasoning would show, that the attraction of the lump D, if placed at A, must now be represented by $\frac{1}{400} = 0{\cdot}0025$; but that, if placed at D, its effective attraction is represented by $\frac{20}{401 \times \sqrt{401}} = 0{\cdot}0024906653$. The difference now is $0{\cdot}0000093347$, or nearly $\frac{375}{100000}$ of the whole attraction of D. Consequently by removing the satellite to twice the distance from A, the difference between the effective attraction of the lump at A and at D bears to the whole attraction of the lump at A a proportion four times smaller than before. And, therefore, the attraction of the spheroid, though still greater than if its whole matter were collected at A, differs from that by a quantity, whose proportion to the whole attraction is only one-fourth of what it was before. If we tried different distances in the same manner, we should find, as a general law, that the proportion which the difference (of the actual attraction, and the attraction supposing all the matter collected at the centre) bears to the latter, diminishes as the square of the distance from A increases.

(232.) The attraction of an oblate spheroid upon a satellite, or other body, in the plane of its equator, may therefore, be stated thus:—There is the same force as if all the matter of the spheroid were collected at its centre, and, besides this, there is an additional force, depending upon the oblateness, whose proportion to the other force diminishes as the square of the distance of the satellite is increased.

(233.) Now, let us investigate the law according to which an oblate spheroid attracts a body, situate in the direction of its axis.

Proceeding in the same manner as before, and supposing the distance A B to be 10, the attraction of the lump, which at A would be represented by $\frac{1}{100}$, will at D be represented by $\frac{1}{81}$, and will at E be represented by $\frac{1}{121}$, (since the distances of D and E from B are respectively 9 and 11). Hence, if the two equal lumps, D and E, were collected at the centre, their attraction on B would be $\frac{1}{100} + \frac{1}{100} = \frac{1}{50} = 0{\cdot}02$.

Fig. 49.



In the positions D and E, the sum of their attractions on B is $\frac{1}{81} + \frac{1}{121} = 0{\cdot}0206100$. The difference is $0{\cdot}0006100$, by which the attraction in the latter case is the greater. Consequently, the attraction of the lumps in the positions D and E is greater than if they were collected at the centre by nearly $\frac{3}{100}$ths of their whole attraction: but the attraction of the whole sphere is the same as if all the matter of the sphere were collected at the centre; therefore, when these parts are removed, they must leave a mass, whose attraction is less than if its whole matter were collected in the centre. With regard to the alteration depending on the distance of B, it would be found, on trial, to follow the same law as before.

(234.) The attraction of a spheroid on a body in the direction of its axis may, therefore, be represented, by supposing the whole matter collected at the centre, and then supposing the attraction to be diminished by a force depending on the oblateness, whose proportion to the whole force diminishes as the square of the distance of the body is increased.

(235.) Since the attraction on a body, in the plane of the equator, is greater than if the mass of the spheroid were collected at its centre, and the attraction on a body in the direction of the axis is less, it will readily be understood, that in taking directions, successively more and more inclined to the equator, on both sides, the attraction successively diminishes. And there is one inclination, at which the attraction is exactly the same as if the whole mass of the spheroid were collected at its centre.

(236.) Now, suppose that a satellite revolves in an orbit, which coincides with the plane of the equator, or makes a small angle with it; what will be the nature of its orbit? For this investigation we have only to consider, that there is acting upon the satellite a force, the same as if all the matter of the spheroid were collected at its centre, and, consequently, proportional inversely to the square of the distance, and that, with this force only, the satellite would move in an ellipse, whose focus coincided with the centre of the spheroid. But besides this, there is a force always directed to the centre, depending on the oblateness. One effect of it will be, that the periodic time will be shorter with the same mean distance, or the mean distance greater with the same periodic time, than if the former were the only force. (46.) Another effect will be, that when the satellite is at its greatest distance, this force will cause the line of apses to regress, and when at its smallest distance, this force will cause the line of apses to progress. (50.) and (53.). If this force, at different distances, were in the same proportion as the other attractive force, it would, on the whole, cause no alteration in the position of the line of apses, (for it would amount to the same as increasing the central mass in a certain proportion, in which case an ellipse, with invariable line of apses, would be described; that is, the regression at the greatest distance would be equal to the progression at the least distance. (*See the note to* (98.).) But (231.) the proportion of this force to the other diminishes as the distance is increased. Consequently, the regression at the greatest distance is less than the progression at the least distance, and, therefore, on the whole, the line of apses progresses. Also, the nearer the satellite is to the planet,

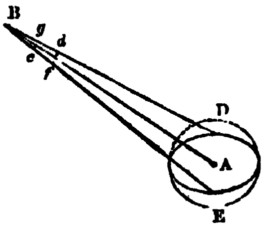
the greater is the proportion of this force to the other attraction; and, therefore, the more rapid is the progression of the line of apses at every revolution. The progression of the line of apses of the moon's orbit, produced by the earth's oblateness, is so small in comparison with that produced by the sun's disturbing force, that it can hardly be discovered; but the progression of the lines of apses in the orbits of Jupiter's satellites, produced by the oblateness of Jupiter, is so rapid, especially for the nearest satellites, that the part produced by the sun's disturbing force is small in comparison with it.

(237.) We shall now proceed with the investigation of the disturbance in a satellite's latitude, produced by the oblateness of a planet.

(238.) First, It is evident that if the satellite's orbit coincides with the plane of the planet's equator, there will be no force tending to pull it up or down from that plane; and, therefore, it will continue to revolve in that plane. In this case, then, there is no disturbance in latitude; we must, therefore, in the following investigation, suppose the orbit inclined to the plane of the equator.

In *fig.* 50, then, let us consider (as before) the effect of the attractions of the two lumps at D and E, in pulling he satellite B perpendicularly to the line A B. Now D is nearer to B than E is; also the line D B is more inclined than E B to A B. If the attraction of D alone acted, it

Fig. 50



would in a certain time draw the satellite to *d*; and *f d* would be the part of the motion of B, which is perpendicular to A B; and this motion is upwards. In like manner, if the attraction of E alone drew B to *e* in the same time, *g e* would be the motion perpendicular to A B, and this motion is downwards. When both attractions act, these effects are combined; the question then is, which is greater, *f d* or *g e*? Now, since D is nearer than E, the attraction of D is greater than that of E, therefore B *d* is greater than B *e*; also B *d* is more inclined than B *e* to B A; therefore *d f* is much greater than *g e*. Hence, the force which tends to draw B upwards is the preponderating force; and therefore, on the whole, the combined attractions of D and E will tend to draw the satellite upwards from the line B A. But the attraction of the whole sphere would tend to draw it along the line B A. Therefore, when D and E are removed, the attraction of the remaining mass (that is, the oblate spheroid) will tend to draw B below the line B A. In estimating the attraction of an oblate spheroid, therefore, we must consider, that besides the force directed to the centre of the spheroid, there is always a force perpendicular to the radius vector directed towards the plane of the equator, or tending to draw a satellite from the plane of its orbit towards the plane of the planet's equator. If the satellite is near to the planet, the inequality of the proportion of the distances D B and E B is increased, and the inequality of the inclinations to B A is also increased; and the disturbance is, therefore, much greater for a near satellite than for a distant one.

(239.) We have seen (215.) the effect of this disturbing force in determining the fundamental planes of the orbits of Jupiter's satellites. And from (192.), &c., we can infer, at once, that this force will cause the line of nodes to regress, if the orbit is inclined to the fundamental plane, and the more rapidly as the satellite is nearer to the planet. If there were no other disturbing force, the inclination of those orbits to the plane of Jupiter's equator would be invariable, and their nodes would regress with different velocities, those of the near satellites regressing the quicker. In point of fact, the circumstances of the inner satellites are very nearly the same as if no other disturbing force existed, so great is the effect produced by Jupiter's oblateness.

(240.) The figure of Saturn, including in our consideration the ring which surrounds him, is different from that of Jupiter; but the same principles will apply to the general explanation of its effects on the motion of its satellites. The body of Saturn is oblate, and the forces which it produces are exactly similar to those produced by Jupiter. The effect of the ring may be thus conceived:—If we inscribe a spherical surface in an oblate spheroid, touching its surface at the two poles, the spheroid will be divided into two parts; a sphere whose attraction is the same as if all its matter were collected at its centre, and an equatorial protuberance analogous in form to a ring. The whole irregularity in the attraction of the spheroid is evidently due to the attraction of this ring-like protuberance, since there is no such irregularity in the attraction of the sphere. We infer therefore that the irregularity in the attraction of a ring is of the same kind as the irregularity in the attraction of a spheroid, but that it bears a much greater proportion to the whole attraction for the ring than for the spheroid, since the ring produces all the irregularity without the whole attraction. Now, the plane of Saturn's ring coincides with the plane of Saturn's equator, so that the effect of the body and ring together is found by simply adding effects of the same kind, and is the same as if Saturn were very oblate. The rate of progression of the perisaturnium of any satellite, and the rate of regression of its node, will therefore be rapid. In other respects it is probable that the theory of these satellites would be very simple, since all (except the sixth) appear to be very small, and the sun's disturbing force is too small to produce any sensible effects.

(241.) The satellites of Saturn, except the sixth, have been observed so little that no materials exist upon which a theory can be founded. A careful series of observations on the sixth satellite has lately been made by Bessel, from which, by comparing the observed progress of the perisaturnium and regression of the node with those calculated on an assumed mass of the ring, the real mass of the ring has been found. It appears, thus, that the mass of the ring (supposing the whole effect due to the ring) is about $\frac{1}{18}$th of the mass of the planet.

(242.) The effect of the earth's oblateness in increasing the rapidity of regression of the moon's nodes is so small, that it cannot be discovered from observation. But the effect on the position of the fundamental plane is discoverable. We have seen (204.) that the moon's line of nodes regresses completely round in $19\frac{1}{3}$ years. The plane of the earth's equator is inclined $23\frac{1}{2}°$ to the earth's orbit, and the line of intersection alters very slowly. At some time therefore the line of nodes coincides with the intersection of the plane of the earth's equator and the plane of the earth's orbit, so that the plane of the moon's orbit lies between those two planes; and $9\frac{2}{3}$ years later, the line of nodes again coincides with the same line, but the orbit is inclined the other way, so that the plane of the moon's orbit is more inclined than the plane of the earth's orbit to the plane of the earth's equator. Now it is found that in the former case the inclination of the moon's orbit to the earth's orbit is greater than in the latter by about 16″, and this shows that the plane to which the inclination has been uniform is neither the plane of the earth's equator nor that of the earth's orbit, but makes with the latter an angle of about 8″, and is inclined towards the former.

(243.) There is another effect of the earth's oblateness (the only other effect on the moon which is sensible) that deserves notice. The inclination of the moon's orbit to the earth's orbit is less than 5°, and the inclination of the earth's equator to the earth's orbit is $23\frac{1}{2}°$. Consequently, when the moon's orbit lies between these two planes, the inclination of the moon's orbit to the earth's equator is about 19°; and when the line of nodes is again in the same position, but the orbit is inclined the other way, the inclination of the moon's orbit to the earth's equator is about 28°. At the latter time therefore, in consequence of the earth's oblateness, the moon, when farthest from its node, will, by (235.), experience a smaller attraction to the earth than at the former time when farthest from its node. When in the line of nodes, the attractions in the two cases will be equal. On the whole therefore the attraction to the earth will be less at the latter time than at the former. For the period of $9\frac{2}{3}$ years therefore the earth's attraction on the moon is gradually diminished, and then is gradually increased for the same time. The moon's orbit (47.) becomes gradually larger in the first of these times, and smaller in the second. The change is very minute, but, as explained in (49.), the alteration in the longitude may be sensible. It is found by observation to amount to about 8

by which the moon is sometimes before her mean place, and sometimes behind it. If the earth's flattening at each pole were more or less than $\frac{1}{300}$th of the semi-diameter, the effects on the moon, both in altering the position of the fundamental plane, and in producing this inequality in the longitude, would be greater or less than the quantities that we have mentioned; and thus we are led to the very remarkable conclusion, that by observing the moon we can discover the amount of the earth's oblateness, supposing the theory to be true. This has been done; and the agreement of the result thus obtained, with that obtained from direct measures of the earth, is one of the most striking proofs of the correctness of the Theory of Universal Gravitation.

GRAVITY, CENTRE OF, is that point at which all the weight of a mass might be collected without disturbing the equilibrium of any system of which the mass forms a part. Thus if a lever were balanced by means of two solid spheres of uniform density hung at the ends, the equilibrium would still remain if all the matter of either of the spheres could be concentrated at its centre. The centre of the sphere is then its centre of gravity.

When a body is suspended by a string, and allowed to find its position of rest, the centre of gravity is in the line of continuation of the string. If then a body be suspended successively at two different points, and if the lines in which the strings produced would cut through the body can be conveniently determined, the centre of gravity is the point of intersection of the two lines. This process is very easy in the case of a thin flat surface, and the approximation is quite sufficient for practical purposes.

When a surface (or a thin plate) is of uniform density, the centres of gravity and of figure [CENTRE] are the same. It is needless to say where this falls in the case of a circle, of a square or other parallelogram, or of a regular oval figure. In a triangle it is found by joining the vertex and middle of the base, and cutting the intercepted line into three equal parts, the nearest trisecting point to the base giving the centre of gravity. In a prism and cylinder it is the middle point of the line joining the centres of gravity of the two bases. In a cone or pyramid it is found by joining the vertex and the centre of gravity of the base, and cutting the joining line into four equal parts, the nearest of which to the base ends in the centre of gravity. In a semicircle the distance of the centre of gravity from the centre is about fourteen thirty-thirds of the radius; in a hemisphere this same distance is five-eighths of the radius.

The centre of gravity of two bodies is found by joining their centres of gravity, and dividing the joining line so that the content of the first may be to that of the second as the segment adjoining the second is to that adjoining the first. By the same rule, and by the centre of two bodies thus found and that of a third, the centre of three bodies may be found, taking care to use with each centre the sum of all the contents of the bodies employed in finding it.

GRAVITY, SPECIFIC. [SPECIFIC GRAVITY.]

GRAY, THOMAS, was born in Cornhill on the 26th of December, 1716. He was the fifth among twelve children of a respectable citizen and money-scrivener in London, and the only one of the twelve who survived the period of infancy.

Gray was sent to be educated at Eton, where a maternal uncle, of the name of Antrobus, was one of the assistant masters. It may be mentioned, that at Eton, and afterwards at Cambridge, Gray was entirely supported by his mother; the father, who was a selfish, violent, and unprincipled man, having chosen to refuse all assistance towards his son's education. At Eton Gray made himself a good classic; and here too began that friendship with West which, shortly terminated by the premature death of the latter, yet forms one of the most interesting features in the history of Gray's early manhood. Horace Walpole was another of his intimate associates at Eton, and, removing thence to Cambridge at the same time with Gray, continued to be so there: West went to Oxford. It was in the autumn of 1735 that Gray commenced his residence at Cambridge, having entered at Peter House; and he continued to reside till September, 1738, when he left without a degree. He professed to hate mathematics, and college discipline was irksome to him. 'You must know,' he writes in his second year to his friend West at Oxford, 'that I do not take degrees, and, after this term, shall have nothing more of college impertinences to undergo.' His time at Cambridge was devoted to classics, modern languages, and poetry; and a few Latin poems and English translations were made by him at this period.

In the spring of 1739 Gray set out, in company with Horace Walpole, and at his request, on a tour through France and Italy. They passed the following winter at Florence with Mr. (afterwards Sir) Horace Mann, the envoy at that court; and after visiting Rome and Naples, and seeing the remains of Herculaneum, which had only been discovered the year before, they passed eleven months more at Florence. While here Gray commenced his Latin poem 'De Principiis Cogitandi.' But the travellers afterwards quarrelled, Gray being, as Horace Walpole has it, 'too serious a companion.' 'I had just broke loose,' says Walpole, 'from the restraint of the university, with as much money as I could spend; and I was willing to indulge myself. Gray was for antiquities, &c., whilst I was for perpetual balls and plays: the fault was mine.' (*Walpoliana*, i. cx.) Gray turned his steps homewards, and arrived in England in September, 1741, just in time to be present at his father's death.

Gray had intended, on leaving Cambridge, to devote himself to the study of the law. His travels had now, for two years and a half, diverted him from this object; and after his father's death he appears entirely to have given it up. He went to reside at Cambridge for the professed purpose of taking the degree of Bachelor of Civil Law, but continued to reside there after taking the degree. Enjoying opportunities of books which he could not command elsewhere, he devoted himself with much ardour to the perusal of the classics, and at the same time cultivated his muse. The 'Ode to Spring' was written in 1742, and sent, like most of his previous compositions, to West, who however had died before it reached him; and in the autumn of the same year were written the 'Ode on a Distant Prospect of Eton College,' and the 'Hymn to Adversity.' The 'Elegy in a Country Churchyard' was also commenced at this period, but not finished till seven years afterwards. In the meanwhile the 'Ode to Eton College' had been published (being the first of Gray's publications) in 1747, and little notice had been taken of it. The 'Elegy,' published in 1749, rapidly obtained an extensive popularity.

In March, 1753, Gray lost his mother, for whom he had always felt the strongest affection, and whom, according to Mr. Mason, he seldom afterwards mentioned without a sigh. During the three years following Horace Walpole observes that Gray was 'in flower.' The 'Ode on the Progress of Poetry' and the 'Bard' were then written. But it was during these three years also that a material change for the worse took place in Gray's health, and that he began to be visited with alarming attacks of the gout, which embittered the remainder of his days, and ultimately carried him off.

In 1756 Gray having experienced some incivilities at Peter House, removed, or (in the technical phrase) migrated to Pembroke Hall. In 1757 he took his two last odes to London to be published. They were not eminently successful. But Gray's reputation had been already established, and on the death of Cibber in the same year he was offered the laureateship by the Duke of Devonshire, which however he refused. He applied himself now for some time to the study of architecture; and from him Mr. Bentham derived much valuable assistance in his well-known 'History of Ely.' In 1765 he visited Scotland, and was there received with many signs of honour. The university of Aberdeen proposed to confer on him the degree of Doctor of Laws; but he declined the honour, thinking that it might appear a slight and contempt of his own university, where he says 'he passed so many easy and happy hours of his life, where he had once lived from choice, and continued to do so from obligation.' In 1768 the professorship of modern history at Cambridge became vacant, and Gray, who on the occasion of the preceding vacancy had applied unsuccessfully, was now appointed by the Duke of Grafton. In the succeeding year the Duke of Grafton was elected chancellor of the university, and Gray wrote the installation ode, a poem which, considering the subject and the occasion, is singularly chaste and free from flattery. In the spring of 1770 illness overtook him, as he was projecting a tour in Wales; but recovering, he was able to effect the tour in the autumn. His respite however was but a short one; and having suffered for some months previous from a violent cough and great depression of spirits, he was

suddenly seized, on the 24th July, 1771, with an attack of the gout in the stomach, which caused his death on the 30th of the same month. He died in his 55th year.

The life of Gray is one singularly (even for an author) devoid of variety and incident. It is the life of a student giving himself up to learning, and moreover accounting it an end in itself, and its own exceeding great reward. For it is not so much that he kept aloof from the active pursuits of life for the purpose of authorship, as that he comparatively sacrificed even this and the fame which belongs to it, by devoting his time almost entirely to reading. Writing was with him the exception, and that too a rare one. His life was spent in the acquisition of knowledge; and there is no doubt that he was a man of considerable learning. His acquaintance with the classics was profound and extensive. He had thought at one time of publishing an edition of Strabo; and he left behind him many notes and geographical disquisitions, which, together with notes on Plato and Aristophanes, were edited by Mr. Mathias. He was besides a very skilful zoologist and botanist. His knowledge of architecture has been already mentioned. He was well versed moreover in heraldry, and was a diligent antiquarian.

He wrote little; but as is the case with all who write little, the little that he wrote was written with great care. Thus his poems, with the exception of one or two of a humorous character, are all much elaborated; and it follows that the quality which they chiefly display is taste. Gray was indeed emphatically a man of *taste*. He did not possess, as has been loosely said by many of his admirers, a vivid and luxuriant imagination, else he would have written more. Neither do we give him credit for a great power of pathos; the proper criticism on his famous elegy seeming to us to be, not that it is pathetic, but that it is eminently tasteful. The Ode to Eton College, also, beautiful as it is, contains nothing which might not be written by any man of cultivated mind and refined taste, possessing no imagination above the common, but taking great pains to select appropriate images and to sustain a loftiness of diction. His 'Ode on the Death of a Favourite Cat,' the 'Long Story,' and many passages of his letters, show that he possessed considerable powers of humour.

A scanty writer, Gray was also a scanty converser; and we learn from Horace Walpole that his conversation partook also of the studied character of his writing. Writing on one occasion to Mr. Montagu, Walpole says, 'My Lady Ailesbury has been much diverted, and so will you too. Gray is in their neighbourhood. They went a party to dine on a cold loaf, and passed the day. Lady A. protests he never opened his lips but once, and then only said, "Yes, my lady, I believe so."' But with his intimate friends he was, as might be expected, less reserved; and to them his conversation was learned and witty. It is unnecessary, after the account which has been given of Gray's life, to dwell on the amiability of his character, his affectionateness, and humility.

An edition of Gray's works, containing, as has been said, his classical notes and disquisitions, as well as his poems and letters, was published by Mr. Mathias, in 2 vols. 4to., in 1814. An edition of his poems and letters alone has been published by Mr. Mitford, first in 1816, in two vols. 4to., and very recently in 4 vols. 12mo. To both of Mr. Mitford's editions is prefixed a memoir of Gray, which is the best that has appeared, and from which the above account has been principally taken.

GRAYLING, a fish of the salmon tribe, inhabiting many of the streams of England, in some of which it is abundant. It is also found in Sweden, Norway, and Lapland. [SALMONIDÆ.]

GRAY'S THURROCK. [ESSEX.]

GRAYSTONE, a term proposed by Mr. Poulett Scrope to include certain volcanic rocks composed of felspar, augite, or hornblende, and iron; the felspar being sometimes replaced by leucite, or melilite.

GREAT BRITAIN has been the legal name of the island containing England and Scotland, and of the kingdom, or part of a kingdom, which they compose, since the legislative union of these two countries (1st May, 1707). The first article of the treaty of Union enacts that the two kingdoms of England and Scotland shall, from the above day, and ever after, be united into one kingdom, by the name of Great Britain: and in subsequent articles the kingdom is called the United Kingdom of Great Britain. The expression however was in common use from the accession of James I. and the union of the crowns in the beginning of the preceding century. The principal subject of the very long speech which James delivered on opening his first parliament, 19th March, 1604, was the expediency of a legislative union of the two countries; but he did not on this occasion introduce the name of Great Britain. In the debates that took place in the course of the session upon this proposal in the House of Commons, one of the arguments employed by those opposed to the measure was that it sprung from a popish root, inasmuch as the first suggestion of it came from the famous Leslie, bishop of Ross, the agent of the late Queen Mary of Scotland, who had advised his mistress to style herself Queen of Great Britain. In the end the scheme was rejected by parliament; but in the mean time James issued a proclamation, on the 20th of October, for uniting the two kingdoms by the name of Great Britain, and declaring the royal style to be, 'King of Great Britain, France, and Ireland.' On the 16th of November he issued a second proclamation, for a new coinage to be current in both kingdoms, which ordered that the inscriptions on the obverse of all coins hereafter struck should be 'Ja. D. G. Mag. Brit. F. & H. Rex;' (James, by the Grace of God, of Great Britain, France, and Ireland, King.) A previous coinage had borne the inscription, 'Jac. D.G. Ang. Sco. Fran. et Hib. Rex.' The new form was followed in all the subsequent reigns, Charles I., Charles II., James II., William III., and Anne (before as well as after the Union) taking on their coins the style of King (or Queen) of Great Britain, &c. Some of the Scotch coins of Charles I. however have 'Car. D. G. Scot. Ang. Franc. et Hib. Rex;' and the name Great Britain does not appear on any of the coins of the Commonwealth. The title of King (or Queen) of Great Britain was also commonly used even in treaties and other state-papers before the Union. But it does not appear that the name can be traced further back than to the suggestion of bishop Leslie. The antient Armorica indeed (now Bretagne, or Britany) appears to have been known from about the sixth century by the name of Britannia Minor (Lesser Britain), as well as by those of Britannia Cismarina and simply Britannia; and our own island may have been occasionally mentioned with an epithet expressive of its magnitude; but such epithet we believe was never, at least among ourselves, considered to be part of its name till the reign of James I. We find however that one of the late Mr. Ritson's assertions, in his 'Observations on Warton's History of English Poetry' (p. 44), is that 'Armorica was by the French called *La Petite Bretagne*; by us, Little Britain; merely to distinguish it from the Island of Great Britain, by them styled *La Grande Bretagne*.' His meaning seems to be that this was an old name of the island among the French.

GREAT BRITAIN, the largest island in Europe, and one of the largest in the world, is divided from the mainland of Europe by a narrow arm of the sea called the English Channel, which extends along the southern shores of the island and separates it from France [ENGLISH CHANNEL], and by a portion of the Atlantic, which is separated from the main body of the ocean by the island of Great Britain itself. This sea, called the North or German Sea [NORTH SEA], separates Great Britain from Belgium, the Netherlands, Germany, Denmark, and Norway. The English Channel and the North Sea are united by the Straits of Dover. To the north of Great Britain lies the wide expanse of the Atlantic Ocean. On the west side of the island, and at no great distance from it, are numerous small islands, and a large one, Ireland, which is separated from Great Britain by St. George's Channel.

The Lizard Point, the most southern part of Great Britain, is in 49° 58′ N. lat., and Dunnet Head, in Caithness, the most northern point, is in 58° 42′ N. lat. The most eastern point is Lowestoft, on the coast of Norfolk, 1° 46′ E. long., and the most western, Airdnamurchan Point, in Argyle, 6° 20′ W. long. The distance in a straight line between the Lizard Point and Dunnet Head is about 608 miles. 'The figure of Great Britain has been compared to an irregular triangle, the apex of which is at Dunnet Head, and the base is the long line of the southern coast from the North Foreland in Kent to the Land's End in Cornwall. The direct distance from Dunnet Head to the North Foreland is about 540 miles, and to the Land's End about 600; the direct distance between the North Foreland lighthouse and the Land's End is about 320 miles.' (*Geogr. of Great Britain*, published by

the Society for the Diffusion of Useful Knowledge.) These distances give an outline of 1460 miles; but as the coast, especially on the western side, is a succession of projecting promontories and deeply penetrating bays, the real coast-line probably exceeds three times that amount. In Sinclair's 'Statistical View of Scotland' the sea-coast of that part of the island, reckoning the mainland only, is stated to be 2500 miles. The surface of the island is about 83,827 square miles, of which the northern part, called Scotland, contains 26,014, and the southern, or England and Wales, the remainder. The line by which the two countries are separated begins, on the west, at the north-eastern angle of Solway Frith, and runs along the Esk, Liddel, and Kershope rivers, to a range of mountains which successively bear the names of the Lauriston Hills, Peel Fell, Carter Fell, and the Cheviot Hills. Up to the last-mentioned mountains the boundary-line runs north-east, but at the Cheviot Hills it turns north-north-west and continues in that direction to the banks of the Tweed, a few miles above Coldstream. The remainder of the boundary-line is formed by the course of the Tweed to its mouth, with the exception of the town of Berwick, which, though on the northern bank of the river, belongs to England.

General Survey of its Surface and Soil.—Though Great Britain does not contain such elevated mountain-ranges as many parts of continental Europe, it probably exhibits a greater variety in surface and soil than any other European country of equal extent. In order to present a general view of the surface of this island we divide Scotland, as well as England, into four natural divisions.

1. *Scotland north and west of Glenmore.*—Glenmore is a long but comparatively narrow valley, which extends south-west and north-east in a straight line across the island. On the south-west it begins at the island of Mull, from whose eastern shores a wide gulf or sea-loch runs N.E., and penetrates deeply into the mainland. This gulf, which is called Loch Linnhe, and may be considered as constituting a part of Glenmore, is continued north-eastward in Loch Eil, a branch of Loch Linnhe. At the point where Loch Eil makes a sharp turn to the west, the valley of Glenmore properly begins; it terminates at Inverness, on the Moray Frith. But this frith may also be considered as a portion of Glenmore, and thus the valley will extend to the Sutors of Cromarty, which are about 112 miles from the eastern shores of Mull. Of this length 52 miles are occupied by the two arms of the sea, and the greater part of the intervening space by three lakes, Loch Lochie, Loch Oich, and Loch Ness, which, taken together, are more than 37 miles long. The dry land of the valley consequently occupies only 22 miles in length, and through this space the Caledonian Canal is cut.

The country north and west of Glenmore is the most sterile portion of the island, not one five-hundredth part being fit for cultivation. Nearly the whole of it constitutes one enormous mass of rock, whose upper surface frequently extends in plains, but more usually is covered with rocks, many hundred feet above the general level of the mountain-plain. The level of the plain varies between 500 and 1500 feet above the sea.

The northern part of the plain, extending from a line joining Loch Broom on the west and Dornoch Frith on the east, to the northern shores and Cape Wrath, is an extensive moor, an open undulating land of rocks and bogs, on which a few hills rise at great distances from one another. The highest summits occur on the western side of the plain, where Ben Mhor attains 3220, Ben Hee 2858, and Ben Hope 3061 feet above the sea-level. Another series of isolated hills occurs on the plain in the parallel of Ben Hee, among which Ben Klibreck is 3164 feet, and the summit of the Maiden Paps, called Morbhein, 2334 feet high. The whole of the plain is used as a sheep-walk, and is only an indifferent one; yet the tracts contiguous to the hills and between them produce much better pasture than the great plain which occupies the east and the south part of the region. The long, deep, and narrow valleys by which the northern part of the plain is intersected contain a few acres of cultivable land along their water-courses, but the valleys through which the southern streams run off are extremely narrow, and it is only near their junction with one another or near their influx into the sea that cultivation is practicable. On the north as well as on the west the steep declivities of the table-land terminate abruptly on the coast, and no cultivable land occurs along the shore; but on the eastern coast a low country extends along the shore from half a mile to a mile in width, which in many parts is well cultivated. It extends from Loch Fleet to the Ord of Caithness. Along the Firth of Dornoch also a few cultivable spots occur.

The mountain-plain and the ridges which constitute its boundary do not extend over the north-eastern part of the island. Nearly four-fifths of the county of Caithness form a plain, with an undulating surface, which may vary between 50 and 200 feet above the sea-level. The lower tracts along the water-courses are cultivated, and, though not of great fertility, produce barley, oats, and potatoes. The higher tracts between the rivers are covered with moors, and are not cultivated, but many parts of them afford pasture. The most southern district of Caithness is covered by mountain-ridges, which are the most eastern offsets of the mountain-plain; they contain the Maiden Paps and the Ord of Caithness, which advances close to the sea.

The country south of the line joining Loch Broom and the Firth of Dornoch also contains a very small portion of cultivable ground. By far the greatest and best portion of the arable ground occurs along the eastern shore and on the two peninsulas which are formed by the three friths of Dornoch, Cromarty, and Moray, and on the level tract which unites these peninsulas to the mainland. The soil is not very fertile, but it is in a higher state of cultivation than the low tract in the county of Caithness.

To the west of this comparatively low and level land rises Ben Wyvis to 3720 feet above the sea. It is an extensive mass of rocks, and the whole region extending to the west of it, to the very shores of the Atlantic, is extremely mountainous. It consists, especially in its central parts, of a continual succession of lofty rocks irregularly heaped together, descending in rapid slopes to the water-courses, which run in deep and narrow ravines. It is bare of trees, and in some parts, especially about Loch Torridon, almost destitute of vegetation. Grouse abound where heather is plentiful: the summits are bare and stony; but the greater part of this extensive moorland affords pasture for sheep. Only a few habitations of shepherds are met with, and, along the western shores, at the innermost recesses of the numerous sea-lochs, the huts of some fishermen. On these lochs a few spots of very limited extent are cultivated. Towards the western coast are several high summits, as Kea Cloch, 3600 feet, and Ben Lair, 3000 feet above the sea-level.

South of a line drawn from the innermost corner of Cromarty Frith to Loch Alsh, opposite the island of Skye, the mountain-region changes it character. Parallel ridges run east and west, and between them lie valleys which open on the east to Loch Beauley and Glenmore, and extend nearly to the western coast, from which they are divided by heights of a dismal aspect but of no great elevation. The declivities of the mountains which enclose the valleys are less steep and less sterile, and generally afford pasture for sheep; sometimes, as in the lower part of Glen Garry, they are covered with trees. The upper parts of the valleys are only used as sheep-walks, but along the lower course of the rivers level tracts occur which are fit for cultivation. The mountains along the western coast however are not superior in fertility to those farther north. Glenmore itself contains tracts of arable ground only at its extremities, and where it is met by the valleys which open into it.

2. *Scotland between Glenmore and the Grampians* is divided into two different regions by the high ridge of the Cairn Gorm mountains, or Northern Grampians. [GRAMPIAN MOUNTAINS.] The country west of that range comprehends the valleys of the Spey, Findhorn, Nairn, and Spean, and may be considered as a mountain-plain with an undulating and often a hilly surface. The more elevated portion of it, contiguous to the sources of the Spey and Findhorn, may be 800 feet above the sea-level, but towards the German Ocean, as well as towards Glenmore, it gradually sinks lower, until at a distance of from ten to twelve miles from the German Ocean it may be between 400 and 500 feet. Afterwards it descends rapidly to a low tract of country extending along the shores of the sea from the Spey to the Frith of Moray. Towards the west however the high and rocky country extends to Glenmore, of which it forms the eastern boundary. It is only towards the southern extremity that the high mountain-wall is interrupted for some miles by the wide valley of the lower Spean. On the plain rise the Monagh Leagh Mountains, which traverse it in its length from south-west to north-

east. They commence on the south between the southern extremity of Loch Ness and Loch Laggan, where they are called the Corryarrick Mountains, and terminate near Loch Moy, in the parallel of the north end of Loch Ness. They are sterile, and of considerable breadth, but none of the summits probably exceed 2000 feet in height. The plain itself is partly covered with moor or heath, but extensive tracts produce fine grass, and make excellent sheep-walks. Even agriculture is attended to on the flat tracts along the upper course of the Spey, but on account of the great elevation of the surface the crops do not always ripen, and the rearing of sheep and cattle is therefore preferred. The comparatively level country which divides the mountain-plain from the German Ocean contains several extensive moors (Culloden Moor), and other tracts covered with sand; still some parts of it have a tolerable soil and are cultivated. The tract on both sides of the lower course of the river Spean, which unites with the river Lochie near the southern extremity of Loch Lochie, is rich and well cultivated, and produces excellent crops of oats and barley.

The country east of the Northern Grampians, or of the Cairn Gorm range, contains a much larger portion of arable land. It is partly mountainous and partly hilly. A line drawn from Kincardine Oneil on the river Dee northward to Huntly on the Doveran separates the mountain-region to the west of it from the hills which occupy the greater portion of the country east of the line. The mountain-region is almost entirely covered with the declivities, spurs and offsets of the Northern Grampians, and its narrow valleys can only be used as sheep-walks, very few spots being fit for cultivation. The mountains themselves are in some parts bare, and in others covered with heath; a few however are wooded. The hilly region contains much more arable land, but the quantity is by no means great in the southern districts extending as far north as the river Ury, a tributary of the Don, and the river Don itself. Level and cultivated tracts occur along the water-courses. The country bounded by the rivers Don and Ury on the south, and the Doveran on the west, is also hilly, but the hills in general are comparatively low, generally not rising more than 500 feet above the sea; their ascent is gradual, and the level country between them much more extensive than farther south. Towards the sea these levels spread into plains, which in some places extend from ten to twelve miles inland. Some of the low hills are cultivated nearly to their summits, and others afford pasture for sheep and cattle. There are however also extensive tracts, especially towards the centre, about the sources of the Ythan, which are rocky and cannot be cultivated. Perhaps not much less than one-fifth of the surface of this tract is actually under cultivation.

3. *Scotland between the Central Grampians and the Plain between the Forth and the Clyde.*—This portion of Scotland is traversed by a mountain-range running from south to north. It begins on both sides of Loch Long on the south, and terminates on the north at the western extremity of Loch Rannoch. It may be called the Southern Grampians. [GRAMPIAN MOUNTAINS.]

The country west of this range contains a great portion of unproductive land. In the northern district, bordering on the south on Loch Etive, Awe Water, Loch Awe, and Glen Orchy, no arable land occurs, except a few spots of moderate extent along the shore of the sea and of the sea-lochs. High and rugged mountain-masses occupy the country between Loch Leven and Loch Etive, and farther north; they extend also along Loch Awe, at the northern extremity of which Ben Cruachan rises 3390 feet above the sea-level. East of this mountain-mass, as far as Loch Rannoch, extends the Moor of Rannoch, which on the south and north respectively reaches to Glenorchy and Loch Leven. It occupies nearly 400 square miles, is about 1000 feet above the sea, and a complete desert, its surface being covered by an immense bog, in some places intersected with pieces of rocks and a few pools of black water, and here and there overgrown with yellow rushes. No trees, shrubs, nor even heath occurs on this desolate tract. Contiguous to it on the north, and mostly within the range of the Central Grampians, between Ben Nevis and Loch Ericht, is another mountainous desert, bounded by the valley of the Spean on the north, of about equal extent, but much grander and more interesting in its features.

The country south and west of Loch Etive and Glenorchy is not mountainous, nor can it be called even hilly. It exhibits a succession of plains, elevated from 400 to 600 feet above the level of the sea, and separated from each other by deep valleys, which apparently have been excavated by the rivers. The higher ground is in part covered with heath and grass, though considerable tracts are overspread with bog and moor. The valleys, which are deep but generally open and sometimes wide, both along the rivers and along the banks of the lakes and bays, contain fine woods, and also many tracts of level ground, on which any kind of grain is cultivated except wheat. Probably less than one-tenth of the surface of this region is under cultivation.

The peninsula of Cantyre extends from this region southward to the Mull of Cantyre, a cape rising about 1000 feet above the level of the sea. Its length is nearly fifty miles, and its width may on an average be from six to eight miles. It is hilly, but not mountainous; most of the hills are low, and all of them intersected by fine valleys and level land, the fertile soil of which produces good crops of every kind of grain, including wheat. The arable ground may perhaps cover one-fourth of its surface.

We pass to the east of the Southern Grampians. Contiguous to this range, and over the angle formed by it and by the Central Grampians, extends a mountain-region which occupies nearly half the surface of the country which we are now surveying. Its eastern border runs in an oblique line over the whole breadth of the island, beginning at Loch Lomond and passing through Aberfoil on the Forth, Callander on the Teith, Crief on the Earn, Dunkeld on the Tay, and Blair Gowrie on the Isla, whence it proceeds to the eastern extremity of the Central Grampians near Stonehaven. All this immense tract of country is covered by ridges of mountains, most of which are offsets from the Southern Grampians, and contain several high summits. [GRAMPIAN MOUNTAINS.] Yet the valleys between the ridges are frequently wide, and contain extensive tracts of arable land, especially along the Earn and the Tay; and agriculture is carried up them to within a short distance from the principal mountain-ranges. Many of the mountains are bare rocks, others covered with heath and moor, but some afford good sheep pasture.

To the east and south of this mountain-region extends Strathmore,* the Great Vale, which begins on the banks of the river Forth opposite Stirling, and extends to Stonehaven, occupying a space of at least eighty miles in length, and from sixteen to one mile in breadth. This plain contains a greater portion of continuous cultivated land than any other part of Scotland, and though its soil is light, sandy, and not of the first quality, it produces rich crops of barley and other kinds of grain, and is particularly adapted for the growth of potatoes.

Between Strathmore and the German Ocean lie two hilly tracts, of which the northern comprehends the southern portion of the county of Forfar, and is called the Sidlaw Hills; the southern extends over Fife, Kinross, and Clackmanan, and is named the Ochill Hills. The Sidlaw Hills and their declivities occupy the whole country between the sea, the Frith of Tay, the river Tay and its affluent the Isla, and the river Esk, and extend from opposite Perth to opposite Brechin. The higher portion of these hills skirts the banks of the Tay, and their highest summit, Craig Owl, not far from Lundie, attains an elevation of 1600 or 1700 feet. Towards the sea these hills gradually decrease in height, or rather form a succession of terraces, which grow lower and lower as they approach the sea. Some fifty years ago they were nearly covered with heath and moor, but since that time the greatest part of their surface has been converted into fields and rich pastures. At the southern extremity of this region, along the Frith of Tay, between the towns of Perth and Dundee, lies the Carse of Gowrie, one of the most fertile tracts in Scotland, and perhaps in Great Britain. Its breadth averages between two and three miles. It produces abundant crops of every kind of grain, and also a considerable quantity of fruit.

The Ochill Hills constitute rather a mountain-region, which from the mouth of the river Tay extends to that of the Forth, and whose principal ranges lie to the west of Loch Leven in Kinross. Within this range are some pastoral glens, and also some level tracts fit for cultivation. The county of Fife, which lies contiguous to this mountain-tract, is traversed by its offsets, but these ranges are generally so low that they do not rise to the elevation of hills,

* In a general description it seems best to include the whole of this long valley under the term Strathmore, though different parts of it bear different names.

and only serve to diversify the surface of this fine country. The greatest part of them is under cultivation, and hence the county of Fife is as rich in agricultural produce as any part of Scotland, East Lothian excepted. A few hills rise to some height, as the Largo Law, near the Frith of Forth, which is 952 feet, and the Normans' Law, on the Frith of Tay, which is about 1500 feet above the sea.

The region of the Ochill Hills and Strathmore is bounded on the south by the river Forth. South of this river lies a hilly country, which extends westward to the very banks of the Frith of Clyde, but approaches the Frith of Forth only within ten or twelve miles. The ridges which extend over this tract go by the name of the Campsie Hills. [CAMPSIE HILLS.] They are mostly covered with heath, and contain a very small portion of arable land.

The Campsie Hills form the northern boundary of the plain, which extends between the Forth and the Clyde, and occupies the whole space from the neighbourhood of Stirling to the mouth of the river Avon, marking the boundary between the counties of Stirling and Linlithgow. It is however difficult to fix its termination towards the south, where a more hilly country joins it, and rises imperceptibly towards Leven Seat, near the upper branches of the river Almond, in the south-western angle of Mid Lothian. In a general description it is perhaps best to extend it to the banks of the Almond up to the Leven Seat, and then to continue the line from this point to the river Clyde near Hamilton. The northern part of this plain, in its central parts, is only from 160 to 180 feet above the sea; its surface is only undulating, and by far the greatest part of it covered with heath and moss, except where it approaches the rivers, where the cultivated land occupies a larger portion of the surface. The southern part is rather hilly, as already observed; and a ridge of high hills stretches over the county of Linlithgow, south and north, between Bathgate and Linlithgow.

4. *Scotland south of the Plain between the rivers Clyde and Forth, or Southern Scotland.*—This portion of Great Britain contains an extensive mountain-region. On the west it advances to the very shores of the sea, extending over the whole portion of Ayrshire which is south of the river Ayr. Its northern boundary follows the course of that river to the Haughshaw Hills, whence it extends to Lanark on the Clyde, and from Lanark to the Leven Seat. Nearly the whole of the county of Edinburgh is included in it. On the east it proceeds first southward along the boundary of that county, but afterwards enters the county of Berwick, of which it occupies the most western part, along both sides of the river Lauder, an affluent of the Tweed. From Melrose, near the mouth of the Lauder, it runs south by west to the Wisp Hill, in the boundary-range between Roxburgh and Dumfries. Here the southern boundary-line begins, and stretches in a south-western direction across the county of Dumfries to Cross Michael, on the Dee river, in Kirkcudbright. It then follows the course of this river to Kirkcudbright Bay, where it again comes close to the sea, forming the high and very bold coast on the eastern shores of Wigton Bay as far as Creetown. From the innermost corner of this bay it runs along the Cree river to the boundary-line of Ayrshire, so that only the county of Wigton is, in this part, excluded from it.

This mountain-region lies in the direction of the greatest width of this part of the island, that is, from south-west to north-east. But the most considerable and extensive depression in it extends east and west, comprehending the valley of the Tweed from Melrose to Peebles and Lyne, and the valley of the Clyde from Covington to Lanark.

The highest summits and ridges occur to the south of this depression. In the western district of Kirkcudbright is the Cairn Muir, 2600 feet high; and, situated about six miles north of Creetown, near the place where the counties of Kirkcudbright, Ayr, and Dumfries meet, the Blacklarg, 1970 feet high. But the highest summits are in the range of mountains which divides the waters that fall into Solway Frith from those which run to the Clyde and Tweed. The Lowthers, between the Nith and Clyde, rise to 3150 feet; Queensberry Hill, at the sources of the Clyde, to 2259 feet; Hartfell, near the sources of the Tweed, to 2790 feet; White Comb, a little east of it, to 2685 feet; Ettrick Pen, near the sources of the Ettrick, to 2270 feet; and Wisp Hill to 1940 feet. The Tinto Hills, which lie rather isolated in the valley of the Clyde, attain the elevation of 2250 feet. The valleys of this region are rather narrow; the declivities of the mountains frequently steep, but where the rock is not bare, they are covered with a sward of fine grass and afford excellent sheep-pastures. The arable land in the valleys is in general of small extent.

In the northern portion of the mountain-region the high land rises with a more gentle slope, and not to so great an elevation. The upper part does not consist of elevated summits or narrow ridges, but extends in spacious flats or inclined plains, which are mostly covered with bogs and mosses, and in some parts clothed with heath. The most elevated portion of this region lies along the watershed between the rivers which fall into the Tweed and into the Frith of Forth, and its elevation may be between 800 and 1000 feet. The Muirfoot Hills, between the sources of the Gala Water, an affluent of the Tweed, and of the Esk, which falls into the Frith of Forth, rise to 1860 feet, and the Leven Seat to about 1200 feet. On the northern declivity are situated the Pentland Hills. [EDINBURGH.] The mountains which include the valleys of the Gala Water and the Lauder bear more resemblance to those south of the Tweed, and rise higher; some summits probably attain an elevation of more than 2000 feet above the sea. The valleys which slope southward to the Tweed have a poor soil, and the uncultivated tracts are numerous and extensive, except along the Gala Water and Lauder, where they are more productive, which is also the case with those embosomed between the ridges of the Pentland Hills and those along the southern shore of the Frith of Forth.

On the west of the mountain-region, between the lower course of the river Clyde and the Frith of Clyde, lies a country, which may rather be called a plain, though it contains some ranges of hills. The Haughshaw Hills, between the Avon and Ayr, soon subside into a level country as we advance towards the west, the highest part of which is between 100 and 150 feet above the sea, and extends along the borders of Ayrshire and Renfrew. But north of Castle Semple Loch and Kilbirnie Loch a ridge of hills rises, which extends over the northern and western districts from Port Glasgow to Greenock and Cloch Point, and thence along the sea-shore towards Ardrossan. The highest part of this hilly tract is the Mistic Law, 1558 feet above the sea. Though some districts on the high land, especially towards the Haughshaw Hills, supply only indifferent pasture for sheep and cattle, a large portion of this country is cultivated, and produces good crops of grain.

The county of Wigton constitutes a separate natural division, being on the north surrounded by mountains, and on all other sides by the sea. It contains no mountains, except on the boundary line on the side of Ayrshire. The remainder is occupied by hills, intersected here and there by wide valleys and plains of moderate extent. The hills along the eastern shores of Luce Bay attain in their highest summits above 1000 feet. Between Luce Bay and Loch Ryan extends a low, sandy, and level plain, the soil of which is only cultivated where it borders on the hilly country. The peninsula called the Ryans is traversed by a ridge of hills from Corsill Point to the Mull of Galloway, but contains a good portion of arable ground; the highest hills rise to between 700 and 800 feet. The eastern portion of Wigton has cultivated tracts along Wigton Bay and the river Cree, but the interior is mostly covered with moor and heath; yet in some parts there is good pasture for sheep.

We pass to the countries to the east and south-east of the mountain-region, which are separated from one another by a range of mountains running west and east. This range may be considered as beginning on the west, on the eastern border of the mountain-region, with Wisp Hill (1940 feet), whence it continues to the boundary-line of England, which it attains between Peel Fell and Carter Fell. Hence it extends north-east along the boundary-line between England and Scotland to the Cheviot Hills, a name by which the whole range is generally designated. [CHEVIOT HILLS.] This range terminates, at a short distance from the Cheviot Hills, in the high land extending from Prendwick, in Northumberland, to Wooler and Mindrum, between the rivers Breamish and Beaumont, which by their union form the Till, an affluent of the Tweed. The highest portion of this range is either bare rock or covered with stones; but the declivities, though rather steep, are generally clothed with a rich, close, green sward, which affords excellent pasture for the breed of sheep called the Cheviots.

The tract of country between this range and the Frith of

Forth, east of the mountain-region, is still traversed by another range of high hills, called the Lammermuir. They occupy the southern portion of East Lothian and the northern parts of Berwickshire, being connected with the mountain-region by the high ground at the sources of the Lauder, and thence stretching eastward to the very shores of the German Ocean, where they terminate in Lumsden Hill (730 feet), and the bold rocky promontory of St. Abb's Head. The space covered by them is of an oval form, being widest in the middle, where it may be 20 miles across. The highest summits occur in the northern ridge, where Layers Law is 1739 feet, Spartleton 1620 feet, and Cockburn Law 1062 feet above the sea. Their summits and sides are naturally poor, but in the valleys fertile and well-cultivated tracts occur.

North of the Lammermuir Hills is the fertile vale of the Tyne, which produces richer crops of wheat than any other part of Scotland, and is in a very high state of cultivation. The high ground which divides it from the Frith of Forth is of inconsiderable elevation and mostly cultivated, except between Aberlady Bay and Tantallan Castle, where it rises to a greater height, the North Berwick Law attaining about 800 feet. But even in this hilly district the larger portion of the soil is under the plough, and only a few tracts are used as pasture.

From St. Abb's Head, the eastern termination of the Lammermuir Hills, a ridge of hills extends along the shores of Berwickshire to the neighbourhood of the town of Berwick in England. They are of moderate elevation, and hardly two or three miles wide. These hills and the Lammermuir enclose on the north and east the Merse of Berwickshire, a plain with a slightly undulating surface, which extends to the banks of the Tweed, between Coldstream and Berwick. Towards the west it approaches the hills which run along the eastern banks of the Lauder. Its surface exceeds 120,000 acres. Its soil is loamy and excellent, and it is cultivated with great care.

This plain does not extend to the range of mountains which unites the mountain-region with the Cheviot Hills, but is separated from it by a hilly country, traversed by the offsets of the mountain-ranges, which surround it on the west, south, and east. Though the greater part of its surface is covered with rather low and broad-backed hills, overgrown with mosses and heath, it contains extensive tracts of good arable land along the rivers, especially the Teviot. In soil and cultivation Teviotdale is not inferior to the Merse of Berwickshire.

The country south of the mountain-region contains a plain, which extends along the Solway Frith from the borders of England to the river Annan, about 20 miles in length, with an average width of about eight miles. Its northern boundary runs from Broomholme on the Esk (about four miles below Langholm), through Solway Bank, Craigshaws, and Ecclefechan to Whinnirig on the Annan. Its surface is mostly low and level, and diversified by some small round-backed hills. Its soil is light and of moderate fertility, and many tracts on it are covered with heath and mosses. Solway Moss properly belongs to England, being included in Cumberland. The country west of the Annan as far as Dumfries is much more hilly, and contains a still smaller portion of cultivable ground, except the valley of the Nith, for some miles above Dumfries, which is rather rich and well cultivated. North of these districts the hills are rather high, and covered with heath and moor; but many of them also with a sward of grass, affording sheep-pasture. The cultivable ground along the bottom of the rivers is of inconsiderable extent and not distinguished by fertility.

The south-eastern portion of Kirkcudbright, which is not enclosed in the mountain-region, is occupied by high hills along the Solway Frith, between the mouth of the Nith and Kirkcudbright Bay. Criffell rises to 1830 feet above the sea. But between this hilly tract and the mountain-region lies a kind of valley, through which the road lies that joins Dumfries with Crossmichael and the towns in Kirkcudbright; it contains a good portion of cultivated ground, but the hilly tract is almost exclusively employed as sheep-walks.

5. *England north of a line drawn from the mouth of the Mersey to Weaver-hill in Derbyshire* (53° N. lat.), *and thence to the junction of the Trent and Ouse.*—This is the only part of England which can be called mountainous. The general direction of the mountain-range which traverses it is from north to south, and its deviations from this line are slight. At its most northern point it is connected with the south-western extremity of the Cheviot Hills [CHEVIOT HILLS], whence it extends southward, mostly along the boundary-line between Cumberland and Northumberland to Cross-Fell, 54° 42′ N. lat., near the junction of the three counties of Cumberland, Westmoreland, and Durham. This portion of the chain is of comparatively small elevation and width. On an average it probably is not more than six miles across. There are no summits distinguished by their elevation; and at the village of Glenwhilt it even subsides to 445 feet above the sea-level. This depression is traversed by the Roman wall, which ran from the Solway Frith to the neighbourhood of Newcastle-on-Tyne, and by the Carlisle and Newcastle railroad. From Cross-Fell, which is 2901 feet above the sea, the range runs nearly south-east to the sources of the Eden river, but afterwards its course is nearly due south. The mountains here grow much wider, especially south of the Eden, where they may be from 20 to 25 miles in width, enclosing the upper valleys of the rivers which fall into the Yorkshire Ouse, as well as of those that empty themselves into Lancaster Bay. The base on which the mountains rest may be from 600 to 800 feet above the sea-level, and there occur several high summits: Shunnor Fell is 2329 feet, Great Wharnside 2385 feet, Ingleborough 2361 feet, and Pen-y-gant 2270 feet above the sea. But towards the place where the range is traversed by the Leeds and Liverpool Canal, the height declines, and the range is also narrower. Pendle Hill however, which is in this neighbourhood, is 1805 feet high. The highest level of the Leeds and Liverpool Canal is 500 feet above the sea. Between the Leeds and Liverpool and the Rochdale Canal the range is less elevated: the highest summit, Boulsworthhill, is only 1689 feet high, and the ridge is also very narrow where it is traversed by the Rochdale Canal. The highest level of this canal is 520 feet above the sea-level. The ridge continues to be narrow as far as Holme Moss, east of Manchester, which is 1859 feet above the sea; but south of this point the mountains again begin to spread out, forming an extensive tract of high land, traversed by various ridges, and intersected by valleys: it is known under the general name of the Derbyshire Mountains. The breadth of this mountain-mass between Macclesfield in Cheshire and Sheffield in Yorkshire is about 22 miles. The highest summits are Castleton, or Lord's Seat, 1751 feet, and Great Axe-edge Hill, 1751 feet. At its southern extremity, Weaver Hill (1154 feet) stands a little west of Ashborne in Derbyshire, and may be considered as the last link of this extensive range, which extends from the Cheviots to the banks of the Trent, and is sometimes called the Pennine Mountains. The higher parts of this range are in general rounded and of easy ascent: they are mostly covered with peat-earth and heath, and exhibit a dreary, bleak, and desolate aspect. In some parts they afford indifferent pasture for sheep.

West of the Pennine Mountains, and contiguous to the boundary of Scotland, is the Cumbrian Plain, which is said to cover a surface of 300,000 acres. It extends along Solway Firth from Solway Moss to the inlet of Abbey Holme, and eastward to the hills of Brompton and Croglin. At its southern extremity, south of Kirk Oswald, it is prolonged in a south-eastern direction by the vale of the Eden, which is of considerable width, as far south as Appleby, and even farther. Though this large plain is not distinguished by fertility, the largest portion of it is under cultivation. Where it borders on the mountain-ridges there are moorlands of some extent.

South of this plain lies the extensive group of the Cumbrian Mountains, which contain the highest summits in England. [CUMBRIAN MOUNTAINS.] The declivities of this mountain-system are generally covered with a fine green sward, which gives excellent pasture for sheep. Between its high summits peat-mosses occur, and the narrow valleys contain only small tracts which can be cultivated, except where they open to the great plain or to the sea.

Opposite Morecambe and Lancaster Bays the offsets of the Pennine range approach the sea within a distance varying from 6 to 12 miles. The intervening space is covered with moor or heath along the foot of the ridge and its offsets, and only a narrow strip of level land extends along the sea; but it is fertile and well-cultivated. South of Lancaster Bay the level country along the coast grows wider. This

tract, which lies to the west of the road running from Lancaster through Garstang to Preston-on-the-Ribble, is from 8 to 10 miles in width, and is called the Fylde. Its surface is rather undulating, but in many parts low and occupied by peat-mosses. The soil is good, and on the whole well cultivated. The tract between the Fylde and the Pennine range is hilly, but contains a large portion of good and well-cultivated land. Between the Ribble and the Mersey, and west of the Pennine chain, extends a high tract, which is encircled by a broad belt of low and level country. This level tract runs from the neighbourhood of Manchester along the Irwell and Mersey to their confluence, and afterwards along the northern banks of the Mersey, south of Prescot, past Liverpool, west of Ormskirk, and then in a north-eastern direction to Preston. The soil is a loam of various quality, in some parts very light and sandy. The tract along the Mersey in the neighbourhood of Warrington is one of the most fertile parts. The high lands enclosed by this level tract contain a good deal of moor, but they are intersected by tracts of arable land, which, though of moderate fertility, are in a high state of cultivation.

South of the Mersey the moorlands, which skirt the mountains of Derbyshire on the west and divide them from the Plain of Cheshire, are not extensive; but at the south-western extremity of the Derbyshire Mountains occur the moorlands of Staffordshire, which occupy the whole of that county north of a line drawn from Newcastle-under-Lyne to Uttoxeter. Some districts of this tract are covered with fine herbage, and supply good pasture for cattle; others consist principally of high moors and peat. Between Cheadle and Oakmoor there is a great number of rude heaps of gravel thrown together in an irregular manner, forming sudden swells and deep narrow hollows.

We pass to the east of the Pennine range. The most northern angle of England, as far south as the Coquet river, is a very hilly country, and some of the eminences are of considerable height. Hebburn or Ros Castle Hill, nearly due west of North Sunderland Point, is 1024 feet high. Still there are tracts of good arable ground amidst the hills, which themselves afford pasture ground. Towards the Coquet the high ground extends in elevated plains (Alnwick Moor, &c.), which are probably 800 feet above the sea-level and covered with heath. The Vale of the Coquet is rather wide, and contains considerable tracts which are noted for their fertility and the excellence of their agriculture.

South of the Coquet begin the xtensive moorlands which extend along the base of the Pennine range through the counties of Northumberland, Durham and York, occupying nearly one-third of Northumberland, that portion of Durham which lies west of a line drawn between Allansford and Barnard Castle, and over Yorkshire, west of Richmond, Ripley, Otley, Halifax, to the Holme Moss in Cheshire. The width of these moorlands varies between 10 and 30 miles; and they are said to be between 500 and 1000 feet above the sea-level. The northern districts are the poorest. They are not marked by any very striking inequalities of surface, being in general extensive, open, solitary wastes, producing little, except heath, and affording only a scanty subsistence to flocks of sheep. The valleys, or rather glens, by which they are furrowed contain very small portions of level ground, and that of an inferior quality. In Yorshire these moorlands are intersected by extensive valleys extending along the numerous rivers which traverse it, and containing considerable tracts of arable land. Considerable tracts of the hills are covered with a fine sweet grass, and others with coarse grass (bent); and where heath prevails it is mostly mixed with grass, bent, or rushes.

The country which extends from the moorland to the German Ocean has in general a hilly character, and the hills in a few places rise to a considerable elevation. Simonside Hill, near the Vale of the Coquet, is 1407 feet high. But the hills do not extend in regular ridges, and are separated from one another by flat tracts, which contain a good soil, particularly along the banks of the rivers. Along the northern side of the Vale of Tyne the high land rises only to a moderate elevation. This vale, though not distinguished by great fertility, has a good soil and is of considerable width; above Newcastle it is rich and picturesque. The country south of the Vale of Tyne is more hilly than that north of it. Near the eastern boundary of the moorlands is Pontop Pike, 1018 feet, and Brandon Mount, 875 feet high. Towards the sea the hills grow lower, but Wordeslow Hill, between Durham and Sunderland, has an elevation of 632 feet. Farther south, towards the Vale of the Tees, the hills are less numerous, less elevated, and have very gentle declivities. Cultivation extends over the flat tracts between them, and even over their declivities. The Valley of the Tees is more extensive than any other in England to the north of it. It extends along the river, from Barnard Castle, where the moorlands terminate, to its mouth, a distance of 40 miles. In its widest part it is 15 miles across, but above Darlington it is rather narrow. Its surface is flat and the soil for the most part productive.

The Valley of the Tees is only separated from the Plain of York by the slight elevation which occurs at some distance from the southern bank of the Tees opposite Darlington. From this point the Plain of York extends southward in a south by east direction to the confluence of the Ouse and Trent, and to Doncaster on the Don, a distance of 70 or 80 miles. It is separated from the Western Moorlands by a hilly tract, which is rather narrow, being perhaps at no place 10 miles in width. If this tract is included, the Vale of York is from 20 to more than 40 miles wide, increasing in width as it advances south. The surface of this plain is somewhat undulating, and sufficiently diversified to give richness and beauty to its appearance. It is in general fertile, and its agriculture is in an advanced state.

The eastern boundary of the Vale is formed by the Eastern Moors and the Wolds of York. The Eastern Moors occupy the northern portion of the county between the Vale and the German Ocean. They extend west and east about 30 miles from Osmotherly, some miles east of Northallerton to Harwood Dale, between Whitby and Scarborough, and about 20 miles north and south between Gisborough and Kirkby Moorside. They form a rounded elevated surface, abutting on the coast in bold cliffs. The central part, which is about 1000 feet above the sea-level, contains Looschoe Hill, 1414 feet, and Dale Head and Bottom Head, farther west, respectively 1864 and 1485 feet high. The greatest part of the high ground is covered with moors and mosses; other parts are covered with loose rocks. The soil consists of peat-earth, and is generally covered with heath. It is intersected by some fertile and well cultivated dales, which contain some thousand acres of good land.

South of the Eastern Moorlands is the Vale of the Upper Derwent, or of Pickering. Its form is an imperfect oval, being 35 miles from west to east and 10 miles from south to north where widest. Its area is nearly 300 square miles. From the Vale of York it is divided by the Hambleton Hills (Black Hambleton rises to 1246 feet), which, under the name of the Howardian Hills, continue in a south-south-east direction to the very banks of the Derwent near Malton, and here form the narrow valley in which that place is built. On the other side of the river rise the York Wolds, which farther east form the southern boundary of the Vale of Pickering. The Vale of the Upper Derwent is therefore everywhere surrounded by heights of considerable elevation, and has all the appearance of a dried lake. Its soil has a considerable degree of fertility, and is well cultivated.

The York Wolds, which form the southern border of this vale, occupy nearly half of the surface of the country between the Derwent and the German Ocean. Their western slope runs from Malton on the Derwent south by east to Hessle on the Humber; and on the east their boundary is marked by the road passing from Hessle to Beverley and Driffield; from Driffield they extend eastward to Bridlington, and occupy the whole coast between Flamborough Head and Scarborough. This extensive tract may on an average be between 200 and 300 feet above the sea: some of its hills rise to more than 500 feet, and a few even to 800 feet; Wilton Beacon, east by north of York, is 809 feet high. It does not contain any extensive moor; the larger part of its surface is covered with grass, and cultivated tracts of moderate extent are frequent.

To the east of the Wolds extends Holderness, a plain with a low but undulating surface, whose greatest elevation is in Dimlington Heights on the sea-coast (146 feet). In some districts of Holderness there are tracts of marshy land, most of which have been drained; but in general it has very little waste land, and may be considered one of the most productive agricultural districts in England. The soil is strong, and produces heavy crops of wheat and beans, and the most luxuriant pasture. Its breeds of sheep and cattle are deservedly celebrated. At its south-eastern ex-

tremity, west of Spurn Head, is a low flat called Sunk Island, which has been rescued from the sea.

6. *England south of a line drawn from the mouth of the Mersey to Weaver Hill, and thence to the confluence of the Ouse and Trent on the north, and the Thames river on the south.*—The western boundary of this extensive region is formed by what may properly be called the Great Western Vale. It extends from the wide æstuary of the river Mersey southward, and chiefly along the Severn to the æstuary of that river and the neighbourhood of Bristol, comprehending the plain of Cheshire and Salop, and the vales of Worcester, Evesham, Gloucester, and Berkeley. Its length may be about 120 miles in a straight line. Its northern portion, or the plain of Cheshire and Salop, extends about fifty miles from north to south, and its breadth varies between twenty-five and thirty miles. A ridge of low hills traverses this plain from north to south in the western districts of Cheshire, between Frodsham on the æstuary of the Mersey and Malpas. In this plain also is the elevated ground which unites the mountain-system of Wales to the central part of England, and forms the watershed between the waters which fall into the Dee and Mersey, and the Severn. This watershed, which is only 309 feet above the tideway of the Dee, runs through the northern part of Shropshire from Whitchurch on the east to Oswestry on the west. Though several tracts covered with heath and moor occur on this plain, yet by far the greatest part has a good soil, and is well cultivated. This plain terminates south of Shrewsbury and Wellington, where the Wrekin on the north, and on the south the ridge called Wenlock Edge, approach so near, as to leave between them only a narrow passage for the Severn. South of this place begins what is properly called the Vale of the Severn. It extends on both sides of the river for about seventy miles, and except at those places where the valleys of the tributary rivers of the Severn open into it, it never exceeds twelve miles in width, and is often narrowed to five It consists of a low strip of alluvial land along the banks of the river, which varies from a quarter of a mile to a mile and upwards in breadth, and of a more elevated level tract of land, which rises to 50, 100, and even 200 feet above the level of the river, and extends to the foot of the hills which enclose the vale. This vale is one of the most fertile and best cultivated districts of England.

Along the eastern border of this vale extends the highest ground of Central England. It is connected with the Derbyshire mountains by the high land which extends along the borders of Cheshire and Staffordshire, and rises at its lowest point, where it is traversed by the Grand Trunk Canal, to 419 feet, and afterwards runs between Newcastle-under-Lyne and Drayton to the high hill called the Wrekin, about six miles E.S.E. of Shrewsbury, which rises to 1320 feet above the sea-level. Between the Wrekin and the mouth of the Stour, an affluent of the Severn, the hills are of a moderate height; but between the Stour and the Avon are the Lickey Hills, which rise to about 800 or 900 feet. South of the Avon, near Pershore, rises the Bredon Hill, which attains about the same elevation, and is connected with the Cotswold Hills, which terminate in the neighbourhood of Bristol and Bath. [Cotswold Hills.]

On the east of this high land lies the Central Region of England, which on its eastern border is contiguous to the Great Eastern Plain, and on the south terminates on the banks of the Thames. Its surface rises and sinks in gentle undulations, between which there are wide valleys, which in some parts spread out into plains. None of the hills attain an elevation of 1000 feet above the sea-level. The elevations are more numerous towards the valleys of the Trent and Thames than in the country between them. In the basin of the Trent are Castle Ring, west-north-west of Lichfield in Staffordshire, 715 feet high; the Great Barr Beacon, south-south-west of Lichfield, 653 feet; Corley Hill, north-west of Coventry, 521 feet; Bardon Hill, west-north-west of Leicester, 853 feet; and Statherne Hill, near the borders of the Eastern Plain, 490 feet above the sea-level. Along the upper course of the river Thames the high land is of moderate elevation and not continuous. But in the great bend of that river between Goring and Henley begins a broad tract of high land, mainly consisting of chalk, which first runs north-north-east to Tring in Hertfordshire, and thence nearly north-east to Royston: though its continuity is several times interrupted, it may be traced along the eastern margin of the low lands of the Wash, to its termination at Hunstanton Cliff, on the north-west coast of Norfolk. The highest summits are Nuffield, in the bend of the Thames, 757 feet, Wendover Hill, 965 feet, and Kensworth Hill, 905 feet above the sea-level. The south-eastern slope of these hills, which descends to the Thames, is very gentle and diversified by elevations and depressions; but along the north-western slope there is in many parts a steep escarpment, from the summit of which the spectator commands an extensive view of the plain which stretches beneath his feet to the west.

North-north-east of London, in Epping Forest, is Highbeach, 750 feet, and north of Tilbury Castle, not far from the mouth of the Thames, Langdon Hill, 620 feet above the sea. The country between the basins of the Trent and Thames, which is occupied by those of the Avon, Welland, and Nen, exhibits, as already observed, a smaller number of hills. The highest occur along the southern border of the valley of the Avon. Epwell Hill, near the most northern point of Oxfordshire, is 836 feet, and Harbury Hill, in Warwickshire, not far from the borders of Northamptonshire, is 804 feet high. No considerable elevation occurs between Harbury Hill and Bardon Hill in Leicestershire, a distance of more than thirty miles in a straight line. The London and Birmingham railroad, which passes over the highest part of the central districts, is, near Kilsby, 516 feet above the sea, which is only 5 feet lower than Corley Hill in the neighbourhood. All these facts show the small elevation even of the highest ground in this part of England. This is also shown by the small elevation of the rivers at great distances from the sea. The Thames at Lechlade is 258 feet, and at the commencement of the Kennet and Avon Canal at Reading only 135 feet above low-water mark; the Avon, where it is traversed by the London and Birmingham railroad, is only 242 feet; the Nen at Northampton, 198 feet, and the Trent at its junction with the Tame, on the borders of Staffordshire and Derbyshire, only 180 feet above the sea-level.

A country of such vast extent and such an uneven surface must vary extremely in its fertility. But it is to be observed that the higher and consequently drier and poorer lands are only of moderate extent, and that the useless or nearly useless tracts occupy but a very small portion of the surface. Though the greatest part of the remainder has but a light soil, it is well cultivated, and, in general, well adapted to the different purposes of agriculture. The most fertile tracts occur along the Trent, where the Vale of Belvoir, in Nottinghamshire, is distinguished by its rich loam, which is partly under the plough and partly in pasture. It extends from the south-eastern banks of the Trent to the borders of Leicestershire and Lincolnshire. The Vale of Aylesbury, in Buckinghamshire, which is drained by the river Thame, an affluent of the Thames, is still more fertile, and principally appropriated to the dairy and to grazing.

The Great Eastern Plain extends from the river Humber to the mouth of the Thames, and is by nature divided into three different portions, a lower and two higher ones. The lower portion lies round that arm of the sea which is called the Wash, and extends to the south-west. It may be circumscribed by a line beginning on the north in Lincolnshire at Wainfleet, and passing through Bolingbroke to Tattershall, and thence to the neighbourhood of Sleaford; from the last-mentioned place it runs southward to the river Welland, between Stamford and Market Deeping, and to the Nen, between Wansford and Peterborough. From Peterborough it is prolonged to the river Ouse at Huntingdon, whence it runs eastward to the junction of the Cam and Ouse. Its eastern border is defined by the course of the Ouse, and by the small elevation (above mentioned) which runs on the east side of it, and terminates near Hunstanton. This low and marshy country, called the Fens, extends 50 miles from north to south, and 30 in its greatest breadth from Market Deeping to Lynn, at the mouth of the Ouse. The rivers not having the necessary fall to carry off the water, this tract, containing, as it is stated, 700,000 acres, is exposed to floods from sudden falls of rain, and also to inundations of the sea. Different means have been devised to prevent such accidents, and also to promote the general drainage of this extensive level. Several dykes have been erected along the coast, some of which belong to the time of the Roman dominion. Numerous cuts also have been made to drain off the superfluous water, and to give a better outfal to the rivers. Some parts are now well drained, and entirely free from flooding,

but other districts are still very imperfectly reclaimed. The most swampy tract, and that which has caused the greatest expense in drainage, is known under the name of Isle of Ely, and belongs to the course of the Ouse, the Nen, and the low grounds about March and Wisbeach. A great part of the Fens is appropriated to the rearing of cattle and to the dairy, but extensive tracts are also under the plough.

That portion of the great plain which lies to the north of the Fens comprehends Lincolnshire north of a line drawn from Wainfleet to Sleaford. This tract is considerably higher than the fen region south of it, which is called Holland. On the north the high ground forms the banks of the Humber, from Winteringham on the west, to Great Grimsby on the east. From the last-mentioned place a low belt of marshes extends along the shores of the German Ocean, which advances inland to Louth and Burgh, and varies in width from three or four to six or seven miles. Along this coast we find a submarine forest, visible as far as the limits of low water, or about a mile and a half from the land. This low tract is very fertile; the high land west of it and towards the north is dry, almost without streams, and nearly covered with gorse or furze. Farther southward it is lower, and much more fertile, but, in general, is destitute of trees. The lowest and best portion of it is along the banks of the river Witham.

East of the Fens, and comprehending the counties of Norfolk, Suffolk, and Essex, extends a plain, which in its northern districts is between 160 and 200 feet above the level of the sea in the highest parts. Its surface is gently undulating, but becomes more broken as we advance farther north. The small streams which drain this plain generally lie several feet below the general level of the surface. Its fertility, which towards the north is but moderate, increases to the south, and the soil in Essex is unrivalled in England for its rich crops of wheat. In the northern districts uncultivated tracts of moderate extent are frequent, but in the southern parts they are rare. The southern boundary of this plain is marked by the high ground which extends from Epping Forest eastward to Brentwood and Langdon Hill, and then north-east, terminating between Chelmsford and Maldon.

7. *England south of the River Thames and the Bristol Channel.*—Towards the eastern extremity of this region there is an extensive tract of high land, a transverse section of which forms the lofty chalk cliffs along the Straits of Dover, between the South Foreland and Folkstone. From the shores of the straits it extends in a north-northwest direction to the æstuary of the Thames, where it terminates in a moderately high coast between Reculver and the outlet of the East Swale; the high land of the island of Thanet may be considered as an eastern prolongation of it, being separated only by the comparatively narrow depression through which the Stour formerly discharged a portion of its water into the Thames. The eastern slope of this high ground is very gentle, but does not extend to the shores of the sea, a level some miles wide occupying the space between Pegwell Bay and Deal. The greatest elevations occur near the Straits of Dover. Dover Castle is 469 feet, Folkstone Turnpike 575 feet, and Paddlesworth Hill, north-west of Folkstone, 642 feet high. The surface of this elevated tract may, on an average, be about 300 feet above the sea in its higher parts; but at Canterbury, where it is cut by the valley of the Stour, it is probably not so much as 100 feet. Though the soil of this tract is chalky and dry, it has in parts a considerable degree of fertility, and is well cultivated.

The high land continues to the west of the valley of the Stour, and is several miles wide, with a longitudinal depression in the middle, so as to have the appearance of two parallel ridges. The northern ridge, which is a continuation of the chalk, is the higher, and contains Hollingbourn Station, 616 feet above the sea. This high ground runs first north-west, and in its depression lie the towns of Ashford, Charing, and Maidstone. At Maidstone the high lands are interrupted by the Valley of the Medway, but west of it they appear again in the same form, running nearly due west. In the longitudinal depression west of the Medway is Seven-Oaks. This depression becomes narrower as the high lands approach the county of Surrey, and ceases entirely near Westerham. Farther west there is only one ridge, which is properly called the North Downs. It continues west to Guildford and Farnham, growing narrower as it advances farther to the west, so that between Guildford and Farnham it is a mere ridge, called the Hog's Back. Botley Hill, near Westerham, the highest summit, is 880 feet above the sea.

The country between the high lands north-east of Maidstone and the East Swale (one of the outlets of the Medway, which divides the island of Sheppey from the mainland) is a gently-inclined plain, containing small depressions; but before it reaches the water's edge the high land entirely subsides, and is skirted by a low and level tract. The whole district is of average fertility and well cultivated, though almost entirely destitute of watercourses. The country farther west, between the high lands and the lower course of the Thames, is more diversified in its surface, rising sometimes to several hundred feet above the sea, especially south of London, where Norwood is 389 feet, and Banstead Common 576 feet; but the declivities of these elevations are gentle, and between them are extensive tracts of level ground. The higher parts are generally uncultivated, but they constitute only a small portion of the whole; the remainder is of considerable fertility.

The country between the North Downs and the English Channel is divided into two very unequal portions by the South Downs, which begin on the shores of the English Channel in the high promontory of Beachy Head (564 feet), and run as far as Bramber, a distance of 28 miles, in a general direction parallel and close to the coast, which, as far west as Brighton, presents a line of cliffs formed by a longitudinal section of this chalk range. Their breadth from north to south is in some parts 6 miles. Ditchling beacon, about 6 miles north of Brighton, is 858 feet high. West of Bramber they continue in the same direction, but their width decreases to 3 and 3½ miles, and between them and the sea extends a level and low country, which grows wider as we proceed westward, until it measures, from a point north of Chichester to Selsea Bill, 10 miles in width. Chanctonbury Ring, north of Shoreham, is 814 feet, and Rooks Hill beacon, north of Chichester, 702 feet high. North-west of Chichester is Butser Hill, which attains an elevation of 917 feet; and here the South Downs may be considered to terminate. At this point a ridge of hills running north and south, a little to the west of Petersfield, is called the Alton Hills: it terminates at the western extremity of the North Downs near Farnham, and thus forms a junction between the North and South Downs. Its highest summit, Hind Head, is 923 feet above the sea. The South Downs afford excellent sheep-walks, and the plain of Chichester, or the low tract along the sea-shore, is characterized by a high degree of fertility.

Between the North and South Downs, and bounded by the Alton Hills on the west, extends the Weald of Kent, Surrey, and Sussex. This tract may be considered as a plain, though there are undulating tracts in several places, and a few hills rise to a considerable elevation; but the elevations do not constitute a continuous high land, and are separated from one another by extensive flats. The highest summits are Leith Hill, south-west of Dorking, 993 feet high, and Crowborough Beacon in Ashdown Forest, 804 feet high. The level parts of the plain are probably between 100 and 200 feet above the sea-level. The soil of this extensive tract, which contains more than 1000 square miles, is principally clay, partly very stiff and heavy, and partly of a softer and wetter description: in some parts it is mixed with sand. It is in a pretty good state of cultivation, and the pastures are rich and luxuriant.

At the eastern extremity of the Weald, and nearly at an equal distance from the South Foreland and Beachy Head, is Romney Marsh, a low and level tract, containing nearly 50,000 acres. It has been wrested from the sea, and is protected by an embankment against its invasions. No trees grow on this marsh. In some parts, especially near the sea, the soil is a poor sandy gravel; but by far the greatest portion consists of a soft clay, mixed with a greater or less portion of sea-sand, which is uncommonly rich and fertile.

The Alton Hills, which extend, as already observed, from Butser Hill, south-west of Petersfield, to Farnham and the Hog's Back, may be considered as the eastern boundary of a more elevated terrace, which occupies the greater portion of the country south of the Thames, between 0° 40′ and 2° 10′ W. long. It begins south of Windsor with Bagshot Heath, and extends westward to the Salisbury Plain, which constitutes the highest portion of the whole

tract. The southern boundary of this region runs from Butser Hill to Winchester, and thence to Salisbury and Shaftesbury; the western from Shaftesbury to Westbury. The northern boundary is not distinctly marked, but the high lands seem to occupy nearly the whole region south of the Berks and Wilts Canal. Bagshot Heath rises in its highest point to 463 feet, and the lowest tracts of the whole region are probably not much less than 300 feet above the sea-level. Its surface is mostly level, though there are several hills, but they do not rise to a great elevation, except Highclere Hill (900 feet), and the Inkpen (1011 feet), near the place where Hampshire, Berkshire, and Wiltshire meet. The soil, with the exception of the Valley of the Kennet, in the southern district of Berks, is rather sterile, consisting of a flinty gravel, mixed with loose sand and loam. A large portion of its surface is unfit for cultivation; but in many parts it is covered with a fine sward, which furnishes excellent pasture for cattle. Salisbury Plain, the most elevated district of this region, extends 22 miles east and west, and 15 north and south, and constitutes a kind of table-land, which at a distance has the appearance of a plain, but on a closer inspection is found to be traversed by numerous depressions. The soil is generally thin and light; but though unfit for cultivation in many parts, it is covered with a fine green sward that affords excellent pasture for sheep; the narrow valleys contain a better soil, and admit of cultivation. The highest eminences are, Dean Hill, below Salisbury, 539 feet; Thorney Down, east of Old Sarum, 610 feet; and Beacon Hill, farther north, 690 feet. Westbury Down, at its north-western extremity, rises to 775 feet. The Marlborough Downs, which are divided from Salisbury Plain by the Kennet and the Kennet and Avon Canal, are in all respects similar to the Plain, except that their surface is more uneven. From the northern side of the Marlborough Downs a tract of high land runs from Swindon westward past Malmsbury to Tetbury, where it joins the Cotswold Hills.

The country south of the elevated tracts just described, and extending from the Plain of Chichester to Southampton Water, is tolerably level, and though inferior in fertility to the country about Chichester, it contains a considerable portion of good and well cultivated land. But west of Southampton Water begin the extensive heaths of Hants and Dorset, which extend from the river Avon to near Dorchester, including the New Forest. They cover the greatest part of the country between Salisbury Plain and the Purbeck Hills. The Purbeck Hills commence at Studland Bay on the east, and the high land continues in a westerly direction along the coast: it is united to Salisbury Plain by the elevated ground which runs from Beaminster to Shaftesbury, and contains Bulbarrow Hill (927 feet) and Wingreen Hill (941 feet). The heaths of Hants and Dorset are dreary and miserably poor, and here and there maintain only a few cattle and some half-starved sheep.

The elevated tract of country which extends from Bagshot Heath to Westbury Down, and of which the heaths of Hants and Dorset may be considered as an appendage, forms the central region of England south of the Thames. Farther west the face of the country changes considerably, and presents a greater variety in its surface. The northern portion, or that tract which extends from the Vale of Berkeley, the southern part of the Great Western Vale, to the Mendip Hills, has a more broken surface than perhaps any other part of England. It presents a succession of hills, ridges, and wide though commonly deep valleys; and the course of the rivers is considerably depressed below the surface of the adjacent lands. Some high summits occur, as Farley Hill, east-north-east of Bath, 700 feet; Lansdown Hill, north of Bath, 813 feet; and Dundry Hill, south-west of Bristol, 790 feet above the sea-level. The valleys are fertile, and the hills mostly afford good pasture.

From the western edge of Salisbury Plain, near Warminster, a range of hills, or rather high land, commences, which continues westward to Shepton Mallet, where it assumes the character of a distinct range, and is called the Mendip Hills. The Mendips extend about 20 miles in a general west direction; their summit is mostly level, but their sides are steep. Their greatest breadth may be about 5 miles; and Blackdown Hill, the greatest elevation, is stated at about 1100 feet. Bleadon Hill, which may be considered as a continuation of the Mendips, approaches within a short distance of the sea at Uphill Bay. These hills are partly enclosed and cultivated, though their soil is of only moderate fertility: the uninclosed portion, which is covered with heath and fern, affords pasture for sheep.

On the southern side of the Mendip Hills lies an extensive level tract of low land, which occupies the whole country on both banks of the rivers Axe and Brue, and is known by the name of the Brent Marsh. This district, naturally an immense swamp, has been to a considerable extent improved by draining, which however in many places is far from being complete. The soil partly consists of mud and alluvial deposits and partly of strong deep clay, both of great fertility: in some parts there are peat-mosses, which are sometimes five or six feet above the adjacent lands. From the Bristol Channel this low tract extends eastward to the towns of Wells and Glastonbury. Its southern boundary is formed by a tract of high land, called the Polden Hills, which run parallel to the river Brue past Somerton; they do not attain so much as 400 feet above the sea-level. South of this high tract is another plain, whose southern and more elevated portion is mostly covered with mosses and moors, and in general is barren. It extends from Langport southward to Petherton and Ilminster. The northern part belongs to the Vale of Taunton, or of the Tone, which extends westward between the Quantock Hills on the north and the Blackdown Hills on the south. It covers an area of about 100 square miles, with an undulating surface. The soil is of great fertility, and produces the finest crops, fruits, and herbage. The climate is very mild.

The Quantock Hills begin at some distance from the mouth of the river Parret, on the southern shore of Bridgewater Bay, and run westward along the coast and at a short distance from it; in some places they press close upon the sea. At their commencement they are only a few miles wide; but farther west, where they are called the Brendon Hills, they attain a width of eight or nine miles, and only grow narrower where they approach their termination west of Ilfracombe. This wider portion is called Exmoor; and Dunkerry Hill, which may be considered as its eastern extremity, is stated to be 1668 feet above the sea. The elevation of Exmoor is considerable. It contains a few patches of cultivated land, but it is mostly waste, and affords only pasture for a small hardy breed of horses, and a peculiar breed of sheep. On the northern and western hills are swamps of many miles in extent. It covers an area of nearly 20,000 acres.

The Blackdown Hills, which form the southern boundary of the Vale of the Tone, may be considered as beginning west of Bridport, and as extending westward to the mouth of the river Exe. A section of them forms the high cliffs which extend along this coast. Their width is considerable and increases as they proceed westward, where they are 15 miles and more across; but they do not constitute a continuous range, being sometimes interrupted by low tracts. Some summits attain a considerable elevation, as Pillisdon Pen, north-north-west of Lyme, which is 934 feet, and Dumpdon Hill, near Honiton, which is 879 feet above the sea. They chiefly supply pasture for cattle; the cultivated tracts are of no great extent, nor is their soil distinguished by fertility.

To the west of the Blackdown Hills and the Vale of Taunton lies the Vale of the Exe, or of Exeter, whose northern extremity reaches the borders of Exmoor, and in that part is separated only by a hilly tract from the Vale of Taunton. South of Exeter it is narrow as the Blackdown Hills on the east, and the offsets of Dartmoor approach one another within a few miles; but between Exeter and Tiverton it is 15 miles in width. Its surface is mostly strongly undulating, and in some parts even hilly; and as its soil possesses only a moderate degree of fertility, this tract is better adapted for pasture than the growth of grain.

Contiguous to the Vale of the Exe on the west is Dartmoor with its offsets. The principal portion of this great mass of granite is 22 miles from north to south, between Belston, near Oakhampton, and the Plymouth road between the rivers Erme and Avon; and 14 miles from east to west, between Moreton Hampstead and Tavistock. It contains about 80,000 acres. It is a high plateau of irregular surface, in some places covered with huge masses of granite, in others with swamps, or a thin and poor soil. The highest summits are Cawsand Beacon, west of Exeter, 1792 feet high; Rippin Tor, south-west of Exeter, 1549 feet; and Butterton Hill, on the southern extremity of the mountain-mass, 1203 feet above the sea. Its offsets towards the east

are numerous and considerable, and cover the whole tract of country between Exeter and Bolt Head, a space at least equal in extent to that of the principal mass. The hills sometimes rise to a considerable elevation, as Little Haldon, south-west of the mouth of the Exe, which is 815 feet high, and Furland, between Tor-Bay and Dartmouth, which attains 589 feet. But most of the hills have a gentle slope, and, as well as the lower ground, are very fertile, and contain the most extensive orchards in England. The two larger offsets from Dartmoor towards the north, one terminating east of Appledore and the other in Hartland Point, are of moderate elevation.

Dartmoor is separated from the mountains of Cornwall by the comparatively narrow valley of the river Tamar. The high lands of Cornwall extend in one continuous mass to the most western point of England, the Land's End. The most elevated portion of the mountain-mass runs nearly in the middle of the peninsula, and is in many places covered with swamps. Towards the north it lowers considerably, but still forms the high and bold coast along the Bristol Channel. Its southern declivity is less rapid, and in this part the coast is indented by numerous bays; the intervals of low and shelving beach are more frequent along the English Channel than along the northern coast. The highest eminences of this mountain-mass are, Brown Willy, at the source of the river Fowey, 1368 feet; Caradon or Carraton Hill, north of Liskeard, 1208 feet; Kit Hill, near Callington, 1067 feet; and Hensbarrow Down, north-west of St. Austell, 1034 feet. St. Burian and Sennen, both near the Land's End, are respectively 415 and 387 feet. The Cape itself is between 60 and 100 feet above the sea-level. The soil of the mountainous districts is barren and unproductive, and the heights are destitute of trees; agriculture is limited to a few of the vales, which intersect the mass, and to some low tracts near the sea, which have a good soil, adapted to the cultivation of grain and potatoes, and favoured by a very moist and temperate climate.

8. *England west of the Great Western Vale, including Wales.*—This region, the most rugged and mountainous part of England, is intersected, near its central parts, by two deep valleys, the upper extremities of which are separated by some high lands not more than 15 miles across. These are, the valley of the small river Dyfi from Machynlleth to Cardigan Bay, and the valley of the Upper Severn from above Llanidloes to Melverley, where the river enters the Great Western Vale.

North Wales, or the country north of this natural line, contains in its central district a very extensive mass of high land, which occupies more than one-third of the whole. The lowest tracts of this high land are probably not much less than 800 feet above the sea-level, and the cold climate, which is the consequence of such a considerable elevation, renders the whole tract unfit for cultivation, except in a few sheltered places along the banks of the rivers. But even here the thin and stony soil yields only moderate crops of grain. This extensive country is consequently chiefly used for pasture.

Along the north-western edge of this elevated tract extends the Snowdon range, which contains the highest summits in England. It begins near the mouth of the river Conwy, whence it runs south-south-west to the north-eastern corner of Cardigan Bay, a distance of twenty-four miles in a straight line. The width of the range varies from five to seven miles. From both extremities it rises gradually towards the centre, where it contains several summits more than 3000 feet high; the highest is the extensive mountain-mass known under the name of Snowdon, whose highest pinnacle, called Wyddva, attains an elevation of 3571 feet. The greatest part of the rocks are bare, and it is only in the hollows that a coarse herbage grows, which supports a hardy race of sheep and cattle during the summer.

A range of high hills branches off from this range south of the highest part, and runs to Caernarvon Bay, where it terminates south of Clynnog in the Reival, which is 1886 feet high. The peninsula, which extends between Caernarvon Bay and Cardigan Bay, and terminates at Cape Braich-y-Pwll, opposite the island of Bardsey, contains some high hills, but it properly forms an uneven rocky plain here and there intersected by narrow and wet valleys, and diversified with conical hills, isolated, or in small groups. Between the Snowdon range and the Strait of Menai is an extensive and tolerably level plain, but it is not low, the shores of the strait being generally rocky and bold. The soil consists mostly of gravel and sand; its fertility is very moderate.

The highest portion of the elevated mountain-region extends south of the Snowdon range, comprehending the central part and more than half of Merionethshire. On its elevated base two series of mountain-summits are distinguishable. The more western, which is about six miles from Cardigan Bay, contains several high pinnacles, as Rhinog Fach, 2400 feet, and Rhinog Fawr, 2463 feet high; some others rise still higher. It is divided by the narrow valley of the river Maw from another range, which on the south is connected with the Berwyn at the Arran Mowddwy (2955 feet), whence it extends north-north-west to Snowdon. Several summits attain upwards of 2000 feet; the Arennig, between Llyn Arennig and Llyn Tryverin, is 2809 feet high. The country enclosed by these ranges contains some fine picturesque valleys, among which are those of Festiniog and Dolgelley. But nearly the whole tract is only fit for pasture.

The Berwyn range, which constitutes the south-south-eastern boundary of the high mountain-region, traverses the whole country from the Great Western Vale to Cardigan Bay, beginning on the east with the hills north of Chirk Castle, near the confluence of the Dee and of the Ceriog, and running due west to the Moel Ferna, which is 2108 feet high. From this high summit the mountains decline to the south-west, in which direction they terminate on the shores of Cardigan Bay north of Towyn. Their highest summits are Arran Mowddwy and Cader Idris. [Cader Idris.] The lower declivities of this range are covered with fern or gorse, and the higher with heath; peat-mosses are common.

The country between the tributaries of the Upper Dee does not differ in its general description from the elevated mountain-region, except that the hills decrease in height and in steepness as they advance farther north. Still a considerable number of them attain the height of 1500 feet and upwards south of a line drawn from Llanrwst, on the Conwy river, to Ruthyn on the Clwyd, and thence to Mold on the Alyn. The valleys towards this line are wider, and contain a greater proportion of arable land. North of the line are the valleys of the Conwy and of the Clwyd rivers. The valley of the Conwy below Llanrwst rarely exceeds a mile or a mile and a half in width, but it has a comparatively fertile soil and is well cultivated. The valley of the Clwyd is much more extensive, and is noted for its fertility. [Clwyd.] Between these valleys there is an extensive tract of hilly ground called the Hiraethog Hills, some summits of which rise to more than 1000 feet. This tract is covered with heath or ling; the hollows and flats contain excellent peat. The hilly tract, which separates the valley of the Clwyd from the wide æstuary of the Dee and the plain of Cheshire, contains south of Caerwys several summits between 1200 and 2000 feet above the sea, but farther north they are much lower. In the extensive depressions of this tract there is a good portion of arable land of considerable fertility, especially in the valley of Mold, on the banks of the Alyn.

The country extending from the Berwyn range as far south as the valley of the Severn is rather hilly than mountainous; only a few of its summits exceed 1000 feet in elevation, except near the Berwyn Mountains. Though the greatest portion of it is only fit for sheep-walk, and some tracts are quite useless, it still contains considerable strips of arable land in the valleys along the numerous rivers by which it is drained, especially in that of the Vyrnwy, an affluent of the Severn.

The valley of the Severn above Llanidloes is narrow, and only contains a few patches of arable ground, but below Llanidloes it is in general from one to two miles wide, pretty level and not destitute of fertility, though not equal to the valley of the Clwyd. Its cultivation is improving.

The Plinlimmon range, which, beginning from the Plinlimmon Mountain at the source of the Severn, runs along the southern side of the valley of that river in the form of an arc, and terminates on the west of the plain of Shropshire with the Breiddin Hills, forms a natural boundary between North and South Wales. Plinlimmon Mountain is a mass of rocks of great extent, whose highest summit rises to 2463 feet. The Llandinam Mountains, farther east, attain 1898 feet; Long Mountain, not far from Montgomery, is 1330 feet; and the highest summit of the Breiddin Hills, 1199 feet high. This range presents a great regu-

larity in its outline, its surface consisting of a succession of gradual slopes and rounded summits. It is covered with herbage, which affords good pasture for numerous flocks of small fine-woolled sheep.

The hilly country, which extends over the southern districts of Shropshire, and terminates on the banks of the Severn in Wenlock Edge, may be considered as a continuation of the Plinlimmon range. It contains several ridges of hills, running south-west and north-east, in the direction of the eastern portion of the Plinlimmon range. They are separated from one another by longitudinal valleys, drained by small streams running either north or south, and in these valleys there is a good portion of arable land. The general elevation of this tract may be about 800 or 900 feet above the sea, but some summits rise to 1500 feet, and Brown Clee Hill attains 1805 feet. These ridges are mostly covered with grass.

Contiguous to the Plinlimmon range, and on its southern side, extends a vast mountain tract of very desolate character. The towns of Tregaron and Lampeter on the Teify, of Llandovery on the Towey, and of Llyswen on the Wye, lie on its edge and mark its extent on the west and south, while the Wye river forms its boundary on the east from Llyswen to Llangerrig. This is the most extensive waste in England, and resembles the Northern Highlands in Sutherland and Ross-shire. It contains no regular chains, but a succession of rounded hills and depressions, the surface of which is covered with moss and peat resting on clay. In some places there are extensive bogs. Among the peat and bogs are scattered tracts of pasture ground, which produce a very poor herbage, which affords summer pasture for a large number of small hardy sheep. Drugarn Hill, which occupies nearly the centre of the region, rises 2071 feet above the sea. Along its southern extremity, between Llandovery and Llyswen, extends a range called Mynydd Epynt, or the Epynt Hills, which are covered with vegetation, in whose narrow valleys there are many small strips of land capable of being cultivated.

The country between this mountain tract and Cardigan Bay is extremely rugged north of the river Ystwith, and noted for its beautiful scenery, especially along the small river Rheidiol, where the Devil's Bridge attracts many travellers. South of the Ystwith it stretches out into extensive table-lands, intersected by small hills, and broken by numerous water-courses; but this tract is destitute of wood and covered with a scanty vegetation. Talsarn Hill, east of Aberaeron, is 1143 feet high.

From the Bettws Hills, which occupy the centre of the Plinlimmon range, and lie south of Newtown on the Severn, a range issues, running due south, not far from the boundary line between England and Wales, but still within the latter country. It terminates near Crickhowel on the Usk, and is divided into two parts by the wide valley in which the Wye flows from Llyswen and Whitney. That portion which lies north of the Wye is called Radnor Forest, and one of its summits attains 2163 feet. South of the Wye is the Black Forest, or Mynydd y Cader, whose highest summit, the Cradle Mountain, or Pen y Cader Fawr, is 2545 feet above the sea, and higher than Plinlimmon. The tracts lying between these mountains and the great desert farther west, especially the valleys of the Wye and Usk, contain a fair portion of arable ground, and the ranges themselves are covered with vegetation, and afford pasture for sheep and cattle.

The eastern offsets of this range enter Herefordshire, where they terminate, and are followed by the undulating Plain of Hereford, a country of great fertility, and one of the gardens of England. It extends north and south about 30 miles, and east and west perhaps 20 miles; it is divided from the Great Western Vale by the Malvern Hills, which extend along the boundary-line between Worcester and Hereford in an uninterrupted range for about nine miles north and south; but their greatest breadth east and west does not exceed two miles. Hereford Beacon, the highest summit, nearly in the centre of the range, rises 1444 feet above the level of the sea. The Malvern Hills are separated by the wide valley of the river Ledbury, an affluent of the Wye, from another range of hills, which are much lower and run southward until they terminate not far from the place where the Wye enters the Severn. The southern and higher portion of this range, which is called Dean Forest, rises to an average elevation of 900 feet.

The highest land in South Wales begins in the eastern districts of Caermarthenshire, traverses the southern part of Brecknock, and enters the northern portion of Monmouthshire. Its western extremity commences on the banks of the Towy, near Llandybie, some miles south of Llandilo Vawr, and its eastern terminates near Abergavenny, on the banks of the Usk. Its direction is nearly east and west. This range is called, at least through a considerable part of its extent, the Black Mountains, or Forest Fawr. It highest summits are the Caermarthenshire Beacons, on the boundary-line between Caermarthen and Brecknock, which rise to 2596 feet, and the Brecknockshire Beacons, about five miles south-west of the town of Brecknock, which attain an elevation of 2862 feet, and are the highest mountains in South Wales. Though these mountains are in many parts too elevated, steep and rocky for cultivation, they are generally covered with vegetation, and make good sheep-walks.

Some miles south of the Forest Fawr, and nearly opposite to its centre, are the mountains of Glamorgan. The tract which divides the two mountain-systems from one another is considerably lower than either of them, but nearly unfit for cultivation on account of the aridity of its soil. The western offsets of the mountains of Glamorgan approach close to Swansea Bay, and the eastern reach to Pontypool in Monmouthshire. This mountain-system is upwards of 36 miles long, and extends nearly 15 miles in width, from Merthyr Tydvil on the north, to Llantrissant on the south. It presents a very rugged aspect, owing to the steepness of the declivities and the narrowness of the valleys, though the summits of the mountains are generally flat. The soil is partly of a moist nature, covered with peat, and partly dry, with some poor herbage. It lies upon a bed of rock, under which some of the richest beds of coal and iron in England extend.

Along the southern declivity of this mountain-system is the Plain of Glamorgan, which extends over the southern district of that county. Its surface is undulating and intersected by numerous hills and ridges of small elevation. Its coast is formed by calcareous rocks, which generally rise about 100 feet above high-water mark. This is the most fertile tract in South Wales; its soil being excellent, and productive both in corn and grass. A low tract of country, extending from the mouth of the river Taff to that of the Usk, and from the coast three or four miles inland, unites the Plain of Glamorgan to the Plain of Monmouth, which occupies the portion of Monmouthshire lying south of a line drawn from Pontypool to Monmouth. In the middle of this plain a ridge of hills extends in a nearly diagonal line between Monmouth and Newport-on-the-Usk, which in some parts rises perhaps to 1000 feet above the sea. The fertility of the more level ground is nearly equal to that of the Plain of Glamorgan. The coast here is low, and along it runs a flat low country, which extends two or three miles inland, and is protected by embankments of great extent against the sea at high tides and in stormy weather. This low tract is of great fertility.

Between the western portion of the Forest Fawr and Swansea Bay lies a tract of land, which is very hilly near the mountain-range, but becomes less so as it approaches the sea, where it terminates in an undulating surface and a coast about 100 feet high. A great portion of it is covered with moors and heath, and the soil of the remainder is not above mediocrity, with the exception of the Peninsula of Gower, whose surface in form and fertility resembles that of the Plain of Glamorgan. This peninsula separates Swansea Bay from Caermarthen Bay.

At the western termination of the Forest Fawr begins the Vale of the Towy, which extends on both sides of that river with an average breadth of two miles to its mouth, a distance of about 30 miles. Its fertility is above mediocrity, and on the whole it is well cultivated.

The most western promontory of South Wales is traversed by a range of high hills, which are connected with the high lands south of Lampeter on the Teify. They begin to assume the form of a range a few miles south of the place where the Teify turns north towards its termination in Cardigan Bay. In this range the Brennin Fawr is 1285 feet above the sea. This summit is considered as the eastern extremity of the Precelly Mountains, a range which extends east and west about 10 miles, and contains the Cwm Cerwyn Hill, whose summit is 1754 feet high. Farther west the high land sinks lower, but its continuity in a ridge of lower hills may be traced to Strumble Head and St. David's Head.

The country south of this range, to Caermarthen Bay, Milford Haven, and St. Bride's Bay, presents the appearance of an uneven plain, intersected with numerous detached hills, or rocky eminences, of an irregular and conical shape. These rocky eminences rarely support even a slight vegetation; and except the shores of Milford Haven, which are well wooded, the country is almost destitute of trees. The district south of a line from Milford Haven to Tenby, on Caermarthen Bay, is however superior in fertility, and its surface, like the Plain of Glamorgan, extends in an undulating, or rather a level plain, and approaches that of Glamorgan also in the richness of its corn-lands and pastures. Along the shores of Cardigan Bay there are some marshes, which comprise extensive tracts of excellent land; others are covered with sand, or are mere salt-marshes.

The following table shows the length of the principal rivers of Great Britain and the area drained by them:—

Names of the Rivers.	Length of their course. Miles.	Extent of the Basin. Sq. Ms.
The æstuary of the Humber receives the drainage of about 9000 square miles, viz.:—		
The Ouse	120	4800
The Trent	144	4000
The æstuary itself	40	200
The æstuary of the Wash	..	5000
The æstuary of the Thames receives the drainage of about 5500 square miles, viz.:—		
The Thames	200	4800
The Medway	55	700
The æstuary of the Severn receives the drainage of about 5900 square miles, viz.:—		
The Severn	190	4500
The Wye	120	1400
The Tay, including its æstuary	150	2400
The Tweed	100	1820
The Spey	96	1300
The Clyde	90	1200
The Eden	72	1100
The æstuary of the Mersey receives the drainage of about 1050 square miles, viz.:—		
The Mersey, including its æstuary	62	550
The Weaver, falling into the Mersey	55	500
The Tyne	80	950
The Tees, nearly	80	450
The North Dee	70	900
The Ness, including the Garry	60	850
The Forth, exclusive of the Firth	60	840
The Lochie and Spean	50	530
The Nith	58	504
The Findhorn	80	500

Climate.—Being situated nearly in the middle of the temperate zone, Great Britain enjoys the advantages arising from such a geographical position; and in addition to this it has, in common with the greatest part of Western Europe, the mildness of climate peculiar to this portion of the globe, of which extraordinary phenomenon an explanation is given under CLIMATE and EUROPE.

The difference between the climate of Great Britain and the neighbouring continent is chiefly due to its insular position, and its being exposed to the winds which blow across the wide expanse of the Atlantic Ocean. This difference does not affect either the mean annual temperature of the air, or the quantity of rain. There is however a difference sufficiently marked, if we consider the distribution of heat and of rain through the course of the year. It appears that Great Britain is not subject to the same degree of heat in summer, or of cold in winter, as the continental countries lying under the same parallel. Now, as in countries subject to great vicissitudes of heat and cold the human frame is exposed to a variety of diseases dependent on this change, it is perhaps mainly owing to this greater equality of its seasons that the inhabitants of this island enjoy in general a greater share of health and attain a greater age than in most of the continental countries.

As Great Britain extends over nearly nine degrees of latitude, there is some difference in the mean annual temperature of places situated at the extremes of the island, and at any great distance from one another. London and Wick in Caithness are probably about the same elevation above the sea. In London the mean temperature of the whole year is 50·39°; in summer 62·32°, in autumn 51·35°, in winter 39·12°, and in spring 48·76°. At Wick the mean annual temperature is 46·7°, in summer 53·77°, in autumn 48·35°, in winter 40·35°, and in spring 44·41°. The south-western part of England, especially the peninsula between the English and Bristol Channels, has a much milder climate than the countries farther east, a fact sufficiently marked by the mean annual temperature of Plymouth, which is 52·1°. But this observation cannot be extended to the whole western coast. At Glasgow the mean temperature of the whole year is 47·75°, and at Leith, according to the statement of Dr. Brewster, 48·36°; at Edinburgh, which is stated to be about 300 feet above the sea, it is 47° 8′. The highest mean range of the thermometer may be fixed at about 80°, and the lowest about 10°; the cases being rare in which it exceeds the former and falls below the latter: but on the continent of Europe, within the latitudes of Great Britain, it nearly every year attains 90°, and sinks as low as zero. The mean daily range varies considerably with the seasons, being greatest in the summer months, when the mid-day heat is from 18° to 20° greater than the temperature of the air towards sun-rise; while in December and January the difference hardly exceeds 10° or 11°.

Westerly winds prevail all over the island. Rennell, resting his inductions on former observations, gives 5·62 to 9 as the proportion between the winds blowing from the east of the meridian and those coming from the west. But more recent observations have reduced this proportion to 5 to 8. Easterly winds however prevail on the eastern side of the island in the spring and summer months. They are cold and dry, check vegetation, wither the buds, and materially affect the human frame, producing colds and other complaints. In autumn the easterly winds are not frequent, but when they blow they are sometimes accompanied with showers and even long rains. The easterly winds blow continuously for some time: those from the west come on with puffs, and, as it were, by starts. The westerly winds are generally accompanied with rain, and at the same time are more boisterous, especially on the north-western coast of England, and the west coast of Scotland, which is destitute of trees, chiefly from being exposed to the fury of the westerly gales.

The air of Great Britain contains a greater quantity of moisture than most other countries, which shows itself in the frequency and duration of fogs. Strabo remarks that the sun generally shines only for a few hours, and that in the morning and evening it is hid in clouds or fogs; an observation which shows the correctness of his information. Farther it appears to be a fact that Great Britain has a greater number of rainy days than the countries of continental Europe; but at the same time it must be observed that the quantity of rain does not differ materially from that in other parts of Europe. This apparent contradiction is easily explained by observing, that during the latter months of the year a drizzling rain is very common in this island, and that it is nearly impossible to form a true estimate of the whole quantity which fertilizes the soil and imparts to vegetation that freshness and lustre which are admired by all travellers. It is asserted that about two-thirds of the whole quantity of rain falls on the western side of England; but this estimate seems to be somewhat exaggerated. Perhaps we shall be nearer to the truth if we state that the proportion between the quantity of rain that falls on the eastern and western sides is as 3 to 4, the mean annual quantity of the former being about 24 inches, and that of the latter 32 inches. But this proportion is not equally distributed through the seasons; the rain which falls in summer on the eastern side constitutes a much larger portion of the whole quantity than that which falls in the same season on the western side. According to the calculations of the German meteorologist Kämtz, the rain on the western side and eastern side respectively is distributed according to the seasons in the following proportions, the whole quantity on each side being called 100:—

	Western Side.	*Eastern Side.*
Winter	26·4	23·0
Spring	19·7	20·6
Summer	23·0	26·0
Autumn	30·9	30·4
	100·	100·

No part of the island is more exposed to rain than the district within and near the Cumbrian range; the mean annual quantity of rain, according to very exact observations, which falls at Kendal amounts to 56 inches, and at Keswick, within the range, it is said to be as much as 67 inches.

Area of Great Britain.—The area of Great Britain is estimated at about 83,827 square miles, of which England contains

England	50,387
Wales	7,426
Scotland	26,014
	83,827
The area of Ireland is said to be	26,848
That of the Orkneys, Shetland, and Hebrides	4,224
Guernsey	50
Jersey	$62\frac{1}{2}$
Alderney	6
Man	210

The only statement hitherto made which is received with any degree of confidence, on the distribution of the soil of Great Britain, is the following, which was delivered by Mr. William Couling, in 1827, to a Select Committee of the House of Commons appointed to inquire concerning emigration. The calculations are made in statute acres:—

	Arable and Gardens.	Meadows, Pastures, and Marshes.	Wastes capable of Improvement.	Annual Value of Wastes when unimproved.	Incapable of improvement.	Total.
England	10,252,800	15,379,200	3,454,000	1,700.000	3,256,400	32 342,400
Wales	890,570	2,226,430	530,000	200,000	1 105 000	4,752,000
Scotland	2,493,950	2,771,050	5,950,000	1,680,000	8,523,930	19,738,930
British Islands	109,630	274,060	166,000	25,000	569.469	1,119,159
	13,746,950	20,650,740	10,500,000	3,605,000	[illegible]454,799	57,952,489

The following are the counties of England, Wales, and Scotland, with the number of parishes in each county. The ecclesiastical division of BISHOPRICS is given under that article:—

ENGLAND. Counties.	Population in 1831.	Area in Sq. Miles.	No. of Parishes.
Bedfordshire	95,483	463	123
Berkshire	145,389	752	154
Buckinghamshire	146,529	738	202
Cambridgeshire	143,955	857	164
Cheshire	334,391	1052	88
Cornwall	302,440	1330	205
Cumberland	169,681	1523	104
Derbyshire	237,170	1028	139
Devonshire	494,478	2585	467
Dorsetshire	159,252	1006	268
Durham	253,910	1097	76
Essex	317,507	1533	406
Gloucestershire	387,019	1258	339
Hampshire	314,280	1625	313
Herefordshire	111,211	863	219
Hertfordshire	143,341	630	133
Huntingdonshire	53,192	372	101
Kent	479,655	1557	409
Lancashire	1,336,854	1766	70
Leicestershire	197,003	806	212
Lincolnshire	317,465	2611	632
Middlesex	1,358,330	282	190
Monmouthshire	98,130	496	125
Norfolk	390,054	2024	730
Northamptonshire	179,336	1016	303
Northumberland	222,912	1871	85
Nottinghamshire	225,327	837	211
Oxfordshire	152,156	756	217
Rutlandshire	19,385	149	50
Shropshire	222,938	1343	215
Somersetshire	404,200	1645	475
Staffordshire	410,512	1184	142
Suffolk	296,317	1515	510
Surrey	486,334	759	145
Sussex	272,340	1466	311
Warwickshire	336,610	897	205
Westmorland	55,041	762	32
Wiltshire	240,156	1367	300
Worcestershire	211,565	723	171
Yorkshire	1,371,359	5836	613
Total	13,091,005	50,380	9854

WALES.	Population.	Area.	Parishes.
Anglesey	48,325	271	67
Brecknockshire	47,763	754	67
Cardiganshire	64,780	675	65
Caermarthenshire	100,740	974	76
Caernarvonshire	66,448	544	71
Denbighshire	83,629	633	59
Flintshire	60,012	244	27
Glamorganshire	126,612	792	127
Merionethshire	35,815	663	34
Montgomeryshire	66,482	839	54
Pembrokeshire	81,425	610	145
Radnorshire	24,651	426	52
Total	806,182	7,425	844

SCOTLAND. Counties.	Population in 1831.	No. of Parishes.
Aberdeenshire	177,657	88
Argyleshire	101,973	50
Ayrshire	145,055	40
Banffshire	48,604	24
Berwickshire	34,048	34
Buteshire	14,151	5
Caithness	34,529	9
Clackmannanshire	14,729	5
Dumbartonshire	33,211	11
Dumfriesshire	73,770	43
Edinburghshire	219,345	42
Elginshire	34,231	20
Fifeshire	128,839	62
Forfarshire	139,606	54
Haddingtonshire	36,145	24
Inverness-shire	94,797	30
Kincardineshire	31,431	19
Kinross-shire	9,072	5
Kirkcudbrightshire	40,590	28
Lanarkshire	316,819	50
Linlithgowshire	23,291	13
Nairnshire	9,354	6
Orkney and Shetland	58,239	40
Peeblesshire	10,578	15
Perthshire	142,894	78
Renfrewshire	133,443	27
Ross and Cromarty	74,820	32
Roxburghshire	43,663	32
Selkirkshire	6,833	6
Stirlingshire	72,621	25
Sutherlandshire	25,518	13
Wigtownshire	36,258	17
Total	2,365,114	948

	Population.	Area.	Parishes.
Total of England and Wales	13,987,187	57,805	10,698
Total of Scotland	2,365,114		948
Total of Great Britain	16,352,801		11,646

Colonies, &c.—The colonies and foreign possessions of England, with their area and population (when known), are shown in the following statement:—

Name of Colony or Possession.	Area in Square Miles.	Population.	Date of Census (when known).
EUROPE.			
Heligoland	4	3,000	
Gibraltar	$1\frac{2}{3}$	15,008	1834
Malta and Gozo	122	121,926	
Ionian Islands	1,097	194,395	
AFRICA.			
Gambia	..	3,050	
Sierra Leone	..	26,000	
Accra	..	5,000	
Fernando Po			
St. Helena	60	5,000	
Ascension	44	250	
Cape of Good Hope	106,250	153,027	1834
Mauritius	708	90,730	
Seychelles	80	6,600	
Monbassa	....		
ASIA.			
Ceylon	24,448	1,157,047	
Singapore	330	22,000	
Territories of East India Company	500,000	95,000,000	
AUSTRALIA.			
New South Wales	Boundaries not determined.	60,794	1833
Western Australia (Swan River)		1,550	1836
Southern Australia			
Port Phillip			
Van Diemen's Land	24,000	37,800	1834
Melville Island			

Name of Colony or Possession.	Area.	Population.	Census.
AMERICA.	Square Miles.		
North-west Territory—Prince Rupert's Land, Hudson's Bay . .	3,700,000		
Lower Canada	78,669	511,917	1831
Upper Canada	24,029	321,903	1834
New Brunswick	27,704	72,943	
Nova Scotia	15,269	123,848	1827
Cape Breton	3,125	18,700	..
Prince Edward's Island . . .	2,131	32,292	1833
Newfoundland	35,913	62,088	
WEST INDIES.			
Antigua	400	35,300	
Barbadoes	166	101,605	1829
Dominica	260	18,660	1833
Grenada	164	25,422	1834
Guiana—Demerara and Essequibo	} 100,000 {	74,883	1832
Berbice		21,802	1827
Jamaica	6,400	302,666	Slaves.
Montserrat	47	7,245	
Nevis		9,325	
St. Christopher	68	23,133	
St. Lucia	58	14,791	1834
St. Vincent	130	27,122	1831
Tobago	about 300	15,001	183[illegible]
Trinidad	2,020	43,678	
Virgin Islands			
Bahamas	5,424	17,862	1834
Bermudas	..	8,818	
Honduras	62,750	3,794	1833

Population.—There was no enumeration of the inhabitants of this country earlier than 1801. During the preceding century many attempts were made to form a computation of the numbers in England and Wales, and these attempts having been revised after the completion of the census by Mr. Finlayson, the following statement of the number living at each decennary period of the eighteenth century has been adopted, upon his authority, by Mr. Rickman:—

		Increase per Cent.			Increase per Cent.
1700	5,134,516		1750	6,039,684	3·60
1710	5,066,337		1760	6,479,730	7·28
1720	5,345,351	5·50	1770	7,227,586	11·54
1730	5,687,993	6·41	1780	7,814,827	8·12
1740	5,829,705	2·49	1790	8,540,738	9·29

These numbers include men employed in the army and navy, and seamen in the merchant-service, and the computations are made for the middle of each of the years given.

The numerical condition of the population of Great Britain at each of the four enumerations made during the present century, was as under:—

	1801.	1811.		1821.		1831.	
	Number.	Number.	Increase per Cent.	Number.	Increase per Cent.	Number.	Increase per Cent.
England .	8,331,434	9,538,827	14·50	11,261,437	18·05	13,091,005	16·24
Wales . .	541,546	611,788	12·97	717,438	17·27	806,182	12·36
Scotland .	1,599,068	1,805,688	12·92	2,093,456	15 93	2,365,114	13·
Army, Navy, &c. . .	470,598	640,500	—	319,300	—	277,017	—
Total . .	10,942,646	12,596,803	15·11	14,391,631	14·12	16,589,518	14·91

The occupations of the people, so far as the same can be shown in their great leading divisions, and as they were found to exist at the three enumerations of 1811, 1821, and 1831, were as follows:—

	At the end of May in each of the Years specified.	Total Number of Families.	Employed in Agricultural Pursuits.	Employed in Trade, Manufactures, &c.	All other Families.	Centesimal Proportions.			
						Agriculture.	Trade, &c.	All others.	Total.
England . .	1811	2,012,391	697,353	923,588	391,450	34·7	45·9	19·4	100
	1821	2,346,717	773,732	1,118,295	454,690	33·	47·6	19·4	100
	1831	2,745,336	761,348	1,182,912	801,076	27·7	43·1	29·2	100
Wales . . .	1811	129,756	72,846	36,044	20,866	56·2	27·7	16·1	100
	1821	146,706	74,225	41,680	30,801	50·6	28·5	20·9	100
	1831	166,538	73,195	44,702	48,641	43·9	26·9	29·2	100
Scotland . .	1811	402,068	125,799	169,417	106,552	31·3	42·1	26·6	100
	1821	447,960	130,699	190,264	126,997	29·2	42·5	28·3	10
	1831	502,301	126,591	207,259	168,451	25·2	41·3	33·5	100
Great Britain .	1811	2,544,215	895,998	1,129,049	518,868	35·2	44·4	20·4	100
	1821	2,941,383	978,656	1,350,239	612,488	33·2	45·9	20·9	100
	1831	3,414,175	961,134	1,434,873	1,018,168	28·2	42·	29·8	100

On taking the census in 1831 some further particulars relating to the occupations of the people were obtained, as follows:—

	England.	Wales.	Scotland.	Great Britain.
Males 20 years of age and upwards .	3,199,984	194,706	549,821	3,944,511
Agriculture:—				
Occupiers employing labourers .	141,460	19,728	25,887	187,075
Occupiers not employing labourers .	94,883	19,966	53,966	168,815
Labourers employed in agriculture .	744,407	55,468	87,292	887,167
Employed in manufacture, or in making machinery	314,106	6,218	83,993	404,317
Retail trades or handicrafts, either as masters or workmen . . .	964,177	43,226	152,464	1,159,867
Capitalists, bankers, professional and other educated men . . .	179,983	5,204	29,203	214,390
Labourers employed in labour not agricultural	500,950	31,571	76,191	608,712
Other males 20 years of age and upwards (except servants)	189,389	11,180	34,930	235,499
Male servants:—				
20 years of age and upwards . .	70,629	2,145	5,895	78,669
Under 20 years of age . . .	30,777	1,179	2,599	34,555
Female servants	518,705	42,274	109,512	670,491

The Ages of 3,938,496 persons buried in England and Wales, of whom 1,996,195 were males and 1,942,301 were females, during 18 years, from 1813 to 1830, were:—

Age.	Males.	Females.	Both Sexes.	Age.	Males.	Females.	Both Sexes.
Under 1 year,	436,946	341,137	778,083	Betw. 90 & 95 yrs.	11,607	16,491	28,098
Between 1 and 2 years.	139,926	127,017	266,443	.. 95 & 100	2,879	4,813	7,692
.. 2 and 3	78,114	75,900	154,014	100 years.	239	468	707
.. 3 and 4	47,860	46,773	94,633	101	133	225	358
.. 4 and 5	33,693	32,076	65,769	102	70	174	244
.. 5 and 10	87,263	79,732	166,995	103	63	134	197
.. 10 and 15	52,324	52,155	104,479	104	41	90	131
.. 15 and 20	63,405	71,535	134,940	105	29	72	101
.. 20 and 25	76,632	83,400	160,032	106	17	29	46
.. 25 and 30	67,954	79,740	147,694	107	13	21	34
.. 30 and 35	61,462	70,410	131,872	108	10	18	28
.. 35 and 40	62,534	70,438	132,972	109	6	12	18
.. 40 and 45	62,905	66,438	129,343	110	7	11	18
.. 45 and 50	66,770	63,701	130,471	111	2	3	5
.. 50 and 55	69,002	64,408	133,410	112	1	1	2
.. 55 and 60	73,841	68,510	142,351	113	1	1	2
.. 60 and 65	88,453	86,153	174,606	114	—	2	2
.. 65 and 70	93,554	93,098	186,652	117	—	1	1
.. 70 and 75	104,494	108,314	212,808	118	1	—	1
.. 75 and 80	97,714	102,714	200,428	119	1	—	1
.. 80 and 85	77,327	89,010	166,337	120	2	1	3
.. 85 and 90	39,399	47,075	86,474	124	1	—	1

The rate of mortality in England and Wales, deduced from the foregoing account, is as follows:—

Ages.	Males.			Females.			Both Sexes.		
	Decimal.		Died in 1000 at each period of life.	Decimal.		Died in 1000 at each period of life.	Decimal.		Died in 1000 at each period of life.
	Living.	Died.		Living.	Died.		Living.	Died.	
Under 5 years . .	10,000	3687	·369	10,000	3207	·321	10,000	3451	·345
Between 5 and 10 years .	6,313	437	·069	6,793	411	·061	6,549	424	·065
.. 10 and 15 .	5,876	262	·045	6,382	269	·042	6,125	265	·043
.. 15 and 20 .	5,614	318	·057	6,113	368	·060	5,860	343	·059
.. 20 and 30 .	5,296	724	·137	5,745	840	·146	5,517	781	·142
.. 30 and 40 .	4,572	621	·136	4,905	725	·148	4,736	672	·142
.. 40 and 50 .	3,951	650	·165	4,180	670	·160	4,064	660	·162
.. 50 and 60 .	3,301	716	·217	3,510	684	·195	3,404	700	·206
.. 60 and 70 .	2,585	912	·353	2,826	923	·327	2,704	917	·339
.. 70 and 80 .	1,673	1013	·605	1,903	1086	·571	1,787	1049	·587
.. 80 and 90 .	660	585	·886	817	701	·858	738	642	·870
.. 90 and 100 .	75	72	·960	116	110	·948	96	91	·948
100 years and upwards .	3	3	1·000	6	6	1·000	5	5	1·000

An attempt was made to ascertain the ages of persons living at the Census of 1821, and succeeded so far as to exhibit the ages of 12,487,377 persons out of 14,072,331, then forming, exclusive of the Army, Navy, and mercantile Marine, the population of Great Britain. The result was as follows:—

Ages.	England.		Wales.		Scotland.		Great Britain.	
	Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
Under 5 years,	739,762	725,202	51,817	49,487	137,956	133,711	929,535	908,400
Between 5 and 10 yrs.	645,735	636,604	48,123	45,853	125,298	121,573	819,156	804,030
.. 10 and 15	562,209	530,226	41,404	39,140	115,283	109,247	718,896	678,613
.. 15 and 20	475,052	499,638	34,534	35,931	95,319	108,306	604,905	643,875
.. 20 and 30	706,757	845,469	49,023	55,869	137,645	182,712	893,425	1,084,050
.. 30 and 40	555,713	607,867	37,949	41,640	101,107	124,380	694,769	773,887
.. 40 and 50	452,514	468,336	29,815	32,641	82,695	96,991	565,024	597,968
.. 50 and 60	320,092	328,077	22,112	24,083	60,014	73,518	402,218	425,678
.. 60 and 70	215,263	230,009	16,246	19,175	42,309	51,868	273,818	301,052
.. 70 and 80	106,697	114,572	8,335	10,076	19,977	23,298	135,009	147,946
.. 80 and 90	27,052	32,564	2,535	3,751	5,377	6,734	34,964	43,049
.. 90 and 100	1,995	2,888	258	392	620	766	2,873	4,046
100 and upwards	57	111	3	18	40	62	100	191

Productive Industry.—Every estimate that has hitherto been offered of the agricultural productions of England has been altogether vague and unsatisfactory. It is assumed that the average consumption of the population in the article of grain has been equal to 1 quarter, or 8 bushels, for each person. This assumption leaves out of view the consumption by domestic animals, the number of which we have no means of ascertaining. The quantity of meat consumed is equally unknown; we know indeed the number of horned cattle and of sheep sold alive in the London markets, but if these constituted, which they do not, the whole supply provided for the metropolis, we are ignorant what amount

of population is thus supplied; and if this difficulty were got over, it may readily be conceived that the consumption of the metropolis, the centre of wealth and of luxury, would not present adequate data for calculating the consumption of the country at large. The same difficulty exists as regards the production of any of the raw materials of manufacture. We know what quantity of sheep's wool is imported for the use of the spinners and weavers, and also the quantity and value of woollen goods exported, but unless we could learn the weight of wool yielded by the native flocks, no reasonable estimate could be formed with respect to the quantity of woollen manufactures worn and used within the kingdom. The articles are so few in respect of which the home production and consumption are known, that it would be of little value to state here the little that is ascertained upon that subject; all that can be done in this work is to offer the little authentic information that has been ascertained under the various heads to which it more immediately applies.

Public Income and Expenditure.—The public income and expenditure of this country, during the forty-five years that elapsed between the breaking out of the war of the French revolution and 1836, have been upon a scale great beyond all former precedent, and such as, without experience of the fact, would be pronounced impossible for any equal amount of population to sustain. The following table exhibits for each year the produce from taxation, and the amount of loans, on the one hand; and on the other hand it shows the yearly interest paid to the public creditor, the sums applied to the redemption of debt, and the current expenditure of the country.—

	INCOME.			EXPENDITURE.			
Years	Amount of Revenue paid into the Exchequer, the produce of taxation.	Amount received on account of Loans and Exchequer Bills, beyond the amount redeemed in the year.	Total amount raised for public uses.	Interest paid on public debt, funded and unfunded.	Sums applied to redemption of public debt beyond the amount of loans, &c. in the year.	Current annual public expenditure.	Total amount paid and expended in the year.
	£	£	£	£	£	£	£
1792	19,258,814	...	19,258,814	9,767,333	2,421,681	7,670,109	19,859,123
1793	19,845,705	4,877,956	24,723,661	9,437,862	...	14,759,208	24,197,070
1794	20,193,074	6,998,389	27,191,463	9,890,904	...	17,851,213	27,742,117
1795	19,883,520	30,464,831	50,348,351	10,810,728	...	37,603,449	48,414,177
1796	21,454,728	22,244,982	43,699,710	11,841,204	...	30,334,087	42,175,291
1797	23,126,940	30,356,873	53,483,813	14,270,616	...	36,469,993	50,740,609
1798	31,035,363	16,858,503	47,893,866	17,585,518	...	33,541,727	51,127,245
1799	35,602,444	21,714,863	57,317,307	17,220,983	...	38,403,421	55,624,404
1800	34,145,584	23,030,529	57,176,113	17,381,561	...	39,439,706	56,821,267
1801	34,113,146	27,305,271	61,418,417	19,945,624	...	41,383,555	61,329,179
1802	36,368,149	14,638,254	51,006,403	19,855,588	...	29,693,619	49,549,207
1803	38,609,392	8,752,761	47,362,153	20,699,864	...	28,298,366	48,998,230
1804	46,176,492	14,570,763	60,747,255	20,726,772	...	38,649,436	59,376,208
1805	50,897,706	16,849,801	67,747,507	22,141,426	...	45,027,892	67,169,318
1806	55,796,086	13,035,344	71,831,430	23,000,006	...	45,941,205	68,941,211
1807	59,339,321	10,432,934	69,772,255	23,362,685	...	44,250,357	67,613,042
1808	62,998,191	12,095,044	75,093,235	23,158,982	...	49,984,105	73,143,087
1809	63,719,400	12,298,379	76,017,779	24,213,867	...	52,352,146	76,566,013
1810	67,144,542	7,792,444	74,936,986	24,246,946	...	52,618,602	76,865,548
1811	65,173,545	19,143,953	84,317,498	24,977,915	...	58,757,308	83,735,223
1812	65,037,850	24,790,697	89,828,547	25,546,508	...	63,210,816	88,757,324
1813	68,748,363	39,649,282	108,397,645	28,030,239	...	77,913,488	105,943,727
1814	71,134,503	34,563,603	105,698,106	30,051,365	...	76,780,895	106,832,260
1815	72,210,512	20,241,807	92,452,319	31,576,074	...	60,704,106	92,280,180
1816	62,264,546	514,059	62,778,605	32,938,751	...	32,231,020	65,169,771
1817	52,055,913	...	52,055,913	31,436,245	1,826,814	22,018,179	55,281,238
1818	53,747,795	...	53,747,795	30,880,244	1,624,606	20,843,728	53,348,578
1819	52,648,847	...	52,648,847	30,807,249	3,163,130	21,436,130	55,406,509
1820	54,282,958	...	54,282,958	31,157,846	1,918,019	21,381,382	54,457,247
1821	55,834,192	...	55,834,192	31,955,304	4,104,457	21,070,825	57,130,586
1822	55,663,650	...	55,663,650	29,921,493	2,962,564	20,826,567	53,710,624
1823	57,672,999	...	57,672,999	29,215,905	5,261,725	21,746,110	56,223,740
1824	59,362,403	...	59,362,403	29,066,350	6,456,559	23,708,252	59,231,161
1825	57,273,869	...	57,273,869	28,060,287	9,900,725	23,559,741	61,520,753
1826	54,894,989	...	54,894,989	28,076,957	1,195,531	25,808,585	55,081,073
1827	54,932,518	...	54,932,518	28,239,847	2,023,028	25,560,446	55,823,321
1828	55,187,142	...	55,187,142	28,095,506	4,667,965	21,407,670	54,171,141
1829	50,786,682	...	50,786,682	29,155,612	2,760,003	19,919,522	51,835,137
1830	50,056,616	...	50,056,616	29,118,858	1,935,465	18,024,085	49,078,108
1831	46,424,440	...	46,424,440	28,341,416	2,673,858	18,781,882	49,797,156
1832	46,988,755	333,989	47,322,744	28,323,751	5,696	18,050,245	46,379,692
1833	46,271,326	...	46,271,326	28,522,507	1,023,784	16,235,735	45,782,026
1834	46,425,263	...	46,425,263	28,504,096	1,776,378	16,397,605	46,678,079
1835	45,893,369	...	45,893,369	28,514,610	1,270,050	15,884,649	45,669,309
1836	48,591,180	...	48,591,180	29,243,598	1,590,727	17,258,871	48,093,196

Pauperism.—The progress of pauperism in England and Wales, which, until it was checked by the act passed for the amendment of the poor laws in 1834, was proceeding at a ruinous rate of increase, is shown by the following statement of the sums expended in parishes for the relief of the poor, from the middle of the last century to the present time:—

Average of 1748-49-50	£689,971	1812-13	£6,656,105
1776	1,521,732	1813-14	6,294,584
Average of 1783-84-85	1,912,241	1814-15	5,418,845
1803	4,077,891	1815-16	5,724,506

1816-17	£6,918,217	1827-28	£6,298,000
1817-18	7,890,148	1828-29	6,332,410
1818-19	7,531,650	1829-30	6,829,042
1819-20	7,329,594	1830-31	6,798,880
1820-21	6,958,445	1831-32	7,036,968
1821-22	6,358,703	1832-33	6,790,800
1822-23	5,773,096	1833-34	6,317,255
.823-24	5,736,898	1834-35	5,526,418
1824-25	5,786,989	1835-36	4,717,630
1825-26	5,928,501	1836-37	4,044,741
1826-27	6,441,088		

The sums thus expended, if equally apportioned among the people, would have amounted in each of the years during which the census was taken, and in the last year embraced by the foregoing statement, to the following sums:—1801, 9*s*. 1*d*.; 1811, 13*s*. 1*d*.; 1821, 10*s*. 7*d*.; 1831, 9*s*. 9*d*.; 1836, 5*s*. 5*d*. The rate has always borne more heavily upon the agricultural than upon manufacturing counties. In Sussex it was equal in 1801 to 22*s*. 6*d*., in 1811 to 32*s*., in 1821 to 22*s*. 6*d*., and in 1831 to 19*s*. 4*d*. for each inhabitant, being the highest rates borne by any county in those years. In 1836 the highest rate was paid by the county of Suffolk, and was equal to 8*s*. 9*d*. for each inhabitant, being below the average rate for the whole of England in any one of the years in which the census was taken.

Crime.—The progress of crime in England, if estimated by the number of offenders brought before the tribunals, has been quite appalling. The following table exhibits the numbers charged with offences in each of the 25 years from 1813 to 1837 inclusive:—

Year.	Males.	Females.	Total.
1813	5,433	1,731	7,164
1814	4,826	1,564	6,390
1815	6,036	1,782	7,818
1816	7,347	1,744	9,091
1817	11,758	2,174	13,932
1818	11,335	2,232	13,567
1819	12,075	2,179	14,254
1820	11,595	2,115	13,710
1821	11,173	1,942	13,115
1822	10,369	1,872	12,241
1823	10,342	1,921	12,263
1824	11,475	2,223	13,698
1825	11,889	2,548	14,437
1826	12,472	2,692	16,164
1827	15,154	2,770	17,924
1828	13,832	2,732	16,564
1829	15,556	3,119	18,675
1830	15,135	2,972	18,107
1831	16,600	3,047	19,647
1832	17,486	3,343	20,829
1833	16,804	3,268	20,072
1834	18,880	3,571	22,451
1835	17,275	3,456	20,731
1836	17,248	3,736	20,984
1837	19,407	4,205	23,612

From the year 1834, inclusive, a classification of crimes has been made in the returns, which are divided under the six following heads, and the number of convictions in each class is added for the several years:—

	1834.	1835.	1836.	1837.
1. Offences against the person	1,443	1,194	1,219	1,046
2. Offences against property, with violence	1,027	934	911	1,021
3. Offences against property, without violence	12,177	11,372	11,709	13,970
4. Malicious offences against property. .	66	48	46	38
5. Forgery and offences against the currency	361	287	294	358
6. Offences not included in the foregoing classes	921	894	592	657
Total convictions . .	15,995	14,729	14,771	17,090

It is probable that a considerable part of the increase observable in the number of offenders is caused by the greater vigilance of the police, and some part also by the improved tone of moral feeling in the country, which now views as criminal some acts which formerly were not considered so. We may add to these causes the relaxations that from time to time have of late years been introduced into our criminal code, and which, by rendering the punishment more proportionate to the offence, have tended to remove the disinclination to prosecute which was generally manifested, and especially with regard to the graver crimes. But when due allowance has been made for all these circumstances, it must still be felt that the tables exhibit a fearful amount of criminality.

The mitigated severity of our criminal code will be apparent from the following statement of the number of executions that have taken place in each year from 1820:—1820, 107; 1821, 114; 1822, 97; 1823, 54; 1824, 49; 1825, 50; 1826, 57; 1827, 73; 1828, 58; 1829, 74; 1830, 46, 1831, 52; 1832, 54; 1833, 33; 1834, 34; 1835, 34; 1836, 17; 1837, 8 (all for murder).

It is deserving of remark, that although there appears a tendency to increase of offences generally, there is an actual decrease in the number of those crimes as to which the law has been rendered less severe than formerly. In 1836 and 1837 the returns have contained information as to the degree of instruction imparted to those accused of crimes; the result is as follows:—

	1836.	1837.
Neither read nor write . . .	7,033	8,464
Read and write imperfectly . .	10,983	12,298
Read and write well	2,215	2,235
Instruction beyond reading and writing	191	100
Instruction not ascertained . .	562	515
	20,984	23,612

The criminal returns for Scotland do not embrace an earlier period than 1830, from which year to 1836 the result has been as follows. The returns for 1831 do not appear to have been made, and those for 1837 are not yet printed:—

	1830.	1832.	1833.	1834.	1835.	1836.
Number for trial . .	2,063	2,431	2,564	2,711	2,838	2,922
„ convicted .	1,274	1,577	1,796	1,790	1,902	2,182
„ executed .	8	2	3	4	5	1

Foreign Trade.—The actual amount of the foreign trade of the kingdom, and its progress, comparing one with another the different years of the present century, are sufficiently indicated by the following tables, which show the value of imports and exports, the number and tonnage of vessels built and registered, the number and tonnage of vessels belonging to, and of those which arrived at or sailed from, the kingdom in each year from 1801 to 1836. To show the course of the trade, a statement is added of the various countries from which vessels came, or to which they departed, in 1836.

Statement of the Amount of the Foreign and Colonial Trade of the United Kingdom, specifying the Official Value of Foreign and Colonial Merchandise imported and re-exported, and the official, and real or declared value, of British and Irish Produce and Manufactures exported in each Year from 1801 to 1836:—

Years.	Official Value.			Real or declared Value of British and Irish Produce and Manufactures exported.
	Imports of Foreign and Colonial Merchandise.	Exports of Foreign and Colonial Merchandise.	Exports of British and Irish Produce and Manufactures.	
	£.	£.	£.	£.
1801	31,786,262	10,336,966	24,927,684	39,730,659*
1802	29,826,210	12,677,431	25,632,549	45,102,330*
1803	26,622,696	8,032,643	20,467,531	36,127,787*
1804	27,819,552	8,938,741	22,687,309	37,135,746*
1805	28,561,270	7,643,120	23,376,941	38,077,144
1806	26,899,658	7,717,555	25,861,879	40,874,983
1807	26,734,425	7,624,312	23,391,214	37,245,877
1808	26,795,540	5,776,775	24,611,215	37,275,102
1809	31,750,557	12,750,358	33,542,274	47,371,393
1810	39,301,612	9,357,435	34,061,901	48,438,680
1811	26,510,186	6,117,720	22,681,400	32,890,712
1812	26,163,431	9,533,065	29,508,508	41,716,964
1813	Records destroyed by fire.			
1814	33,755,264	19,365,981	34,207,253	45,494,219
1815	32,987,396	15,748,554	42,875,996	51,603,028
1816	27,431,604	13,480,780	35,717,070	41,657,873
1817	30,834,299	10,292,684	40,111,427	41,761,132
1818	36,885,182	10,859,817	42,700,521	46,603,249
1819	30,776,810	9,904,813	33,534,176	35,208,321
1820	32,438,650	10,555,912	38,395,625	36,424,652
1821	30,792,760	10,629,689	40,831,744	36,659,630
1822	30,500,094	9,227,589	44,236,533	36,968,964
1823	35,798,707	8,603,904	43,804,372	35,458,048
1824	37,552,935	10,204,785	48,735,551	38,396,300
1825	44,137,482	9,169,494	47,166,020	38,877,388
1826	37,686,113	10,076,286	40,965,735	31,536,723
1827	44,887,774	9,830,728	52,219,280	37,181,335
1828	45,028,805	9,946,545	52,797,455	36,812,756
1829	43,981,317	10,622,402	56,213,041	35,842,623
1830	46,245,241	8,550,437	61,140,864	38,271,597
1831	49,713,889	10,745,071	60,683,933	37,164,372
1832	44,586,741	11,044,869	65,026,702	36,450,594
1833	45,952,551	9,833,753	69,989,339	39,667,347
1834	49,362,811	11,562,036	73,831,550	41,649,191
1835	48,911,542	12,797,724	78,376,731	47,372,270
1836	57,023,867	12,391,711	85,229,837	53,368,571

* The declared value of British and Irish produce, &c., exported in the years 1801 to 1804, applies to Great Britain only, the real value of exports from Ireland not having been recorded earlier than 1805. The exports from Ireland are, however, inconsiderable.

Statement of the number and tonnage of vessels built and registered in the United Kingdom and its dependencies in various years since 1814 :—

	United Kingdom and Possessions in Europe.		Colonies.		British Empire.	
Years.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
1814	706	86,075	158	11,874	864	97,949
1815	912	102,903	271	25,637	1183	128,540
1816	832	84 676	422	32,725	1274	117,401
1817	758	81,210	324	23,219	1082	104,429
1818	753	86,911	306	17,455	1059	104,366
1819	775	88,985	350	23,188	1125	112,173
1820	635	68,142	248	16,440	883	84,582
1821	597	59,482	275	15,365	872	74,847
1822	571	51,533	209	15,611	780	67,144
1823	604	63,788	243	22,240	847	86,028
1824	837	93,219	342	50,522	1179	143,741
1825	1003	124,029	536	80,895	1539	204,924
1826	1131	119,086	588	86,554	1719	205,640
1827	911	95,038	529	68,908	1440	163,946
1828	857	90,069	464	50,844	1321	140,913
1829	734	77,635	416	39,237	1150	116,872
1830	750	77,411	367	32,719	1117	110,130
1831	760	85,707	376	34,290	1136	119,997
1832	759	92,915	386	43,397	1145	136,312
1833	728	92,171	431	52,476	1159	144,647
1834	806	102,710	425	55,817	1231	158,527
1835	916	121,722	455	63,230	1371	184,952
1836	709	89,636	*376	49,976	*1085	139,612

* The returns for the colonies not having been all received when this account was made up, the numbers for 1836 cannot be accurately given, and are below the truth.

Vessels belonging to the United Kingdom and its dependencies :—

	United Kingdom and Possessions in Europe.		Colonies.		Total.	
Years.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
*1814	21,550	2,414,170	2,868	202,795	24,418	2,616,965
1815	21,869	2,447,831	2,991	203,445	24,860	2,691,276
1816	22,026	2,504,290	3,775	279,643	25,801	2,783,933
1817	21,775	2,421,354	3,571	243,632	25,346	2,664,986
1818	22,024	2,452,608	3,483	221,860	25,507	2,674,468
1819	21,997	2,451,597	3,485	214,799	25,482	2,666,396
1820	21,969	2,439,029	3,405	209,564	25,374	2,648,593
1821	21,652	2,355,853	3,384	204,350	25,036	2,560,203
1822	21,238	2,315,403	3,404	203,641	24,642	2,519,044
1823	21,042	2,302,867	3,500	203,893	24,542	2,506,760
1824	21,280	2,348,314	3,496	211,273	24,776	2,559,587
1825	20,701	2,328,807	3,579	214,875	24,280	2,553,682
1826	20,968	2,411,461	3,657	224,183	24,625	2,635,644
†1827	19,524	2,181,138	3,675	279,362	23,199	2,460,500
1828	19,646	2,193,300	4,449	324,891	24,095	2,518,191
1829	19,110	2,199,959	4,343	317,041	23,453	2,517,000
1830	19,174	2,201,592	4,547	330,227	23,721	2,531,819
1831	19,450	2,224,356	4,792	357,608	24,242	2,581,964
1832	19,664	2,261,860	4,771	356,208	24,435	2,618,068
1833	19,689	2,271,301	4,696	363,276	24,385	2,634,577
1834	19,975	2,312,355	5,080	403,745	25,055	2,716,100
1835	20,300	2,360,303	5,211	423,458	25,511	2,783,761
1836	20,388	2,349,749	5,432	442,897	25,820	2,792,646

* The records of 1812 and 1813 were destroyed at the burning of the Custom-House.

† A new Registry Act (6 Geo. IV., c. 110) came into operation this year; previously to that date many vessels which had been lost from time to time were still continued in the registry, no evidence of their loss having been produced. The present Ship Registry Act in force is 3 and 4 William IV., c. 55, which is in substance the same as 6 Geo. IV., c. 110.

Statement of the number and tonnage of vessels, British and foreign, that entered and cleared from the ports of the United Kingdom, exclusive of the intercourse between Great Britain and Ireland, and of the coasting trade, in each year from 1801 to 1836, so far as the same can be made up from records at the Custom-House :—

INWARDS.

	British.		Foreign.		Total.	
Years.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
1801	4,987	922,594	5,497	780,155	10,484	1,702,749
1802	7,806	1,333,005	3,728	480,251	11,534	1,813,256
1803	6,264	1,115,702	4,254	638,104	10,518	1,753,806
1804	4,865	904,932	4,271	607,299	9,136	1,512,231
1805	5,167	953,250	4,517	691,883	9,684	1,645,133
1806	5,211	904,367	3,793	612,904	9,004	1,517,271
1807	..	...	4,087	680,144	..	...
1808	..	...	1,926	283,657	..	...
1809	5,615	938,675	4,922	759,287	10,537	1,697,962
1810	5,154	896,001	6,876	1,176,243	12,030	2,072,244
1811	.	...	3,216	687,180	..	...
1814	8,9	1,290,248	5,286	599,287	14,261	1,889,535
1815	8,875	1,372,108	5,314	746,985	14,194	2,119,093
1816	9,744	1,415,723	3,116	379,465	12,860	1,795,188
1817	11,255	1,625,121	3,396	445,011	14,651	2,070,132
1818	13,006	1,886,394	6,238	762,457	19,244	2,648,851
1819	11,974	1,809,128	4,215	542,684	16,189	2,351,812
1820	11,285	1,668,060	3,472	447,611	14,757	2,115,671
1821	10,810	1,599,274	3,261	396,256	14,071	1,995,530
1822	11,087	1,664,186	3,389	469,151	14,476	2,133,337
1823	11,271	1,740,859	4,069	582,996	15,340	2,323,855
1824	11,733	1,797,320	5,653	759,441	17,386	2,556,761
1825	13,516	2,144,598	6,968	958,132	20,484	3,102,730
1826	12,473	1,950,630	5,729	694,116	18,202	2,644,746
1827	13,133	2,086,898	6,046	751,864	19,179	2,839,762
1828	13,436	2,094,357	4,955	634,620	18,391	2,728,977
1829	13,659	2,184,525	5,218	710,303	18,877	2,894,828
1830	13,548	2,180,042	5,359	758,828	18,907	2,938,870
1831	14,488	2,367,322	6,085	874,605	20,573	3,241,927
1832	13,372	2,185,980	4,546	639,979	17,918	2,825,959
1833	13,119	2,183,814	5,505	762,085	18,624	2,945,899
1834	13,903	2,298,263	5,894	833,905	19,797	3,132,168
1835	14,295	2,442,734	6,005	866,990	20,300	3,309,724
1836	14,347	2,505,473	7,131	988,899	21,478	3,494,372

OUTWARDS.

	British.		Foreign.		Total.	
Years.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
1801	..	...	..	...	..	...
1802	7,471	1,177,224	3,332	457,580	10,803	1,634,804
1803	5,523	959,787	3,672	574,420	9,195	1,525,207
1804	4,983	906,007	4,093	587,849	9,076	1,493,856
1805	5,319	971,496	3,932	605,821	9,251	1,577,317
1806	5,219	829,574	3,459	568,170	8,678	1,467,744
1807	..	...	3,846	631,910	..	...
1808	..	...	1,802	282,145	..	...
1809	5,488	950,565	4,530	699,750	10,018	1,650,315
1810	3,969	860,632	6,641	1,138,527	10,610	1 999,159
1811	..	...	..	...	..	...
1814	8,620	1,271,952	4,622	602,941	13,242	1,874,893
1815	8,892	1,398,688	4,701	751,377	13,593	2,150,065
1816	9,044	1,340,277	2,579	399,160	11,623	1,739,437
1817	10,713	1,558,336	2,905	440,622	13,618	1,998,958
1818	11,445	1,715,488	5,399	734,649	16,844	2,450,137
1819	10,250	1,562,332	3,795	556,511	14,045	2,118,843
1820	10,102	1,549,508	2,969	433,328	13,071	1,982,836
1821	9,797	1,488,644	2,626	383,786	12,423	1,872,430
1822	10,023	1,539,260	2,843	457,542	12,866	1,996,802
1823	9,666	1,546,976	3,437	563,571	13,103	2,110,547
1824	10,157	1,657,533	5,026	746,707	15,083	2,404,240
1825	10,848	1,793,994	6,075	905,520	16,923	2,699,514
1826	10,844	1,737,425	5,410	692,440	16,254	2,429,865
1827	11,481	1,887,682	5,714	767,821	17,195	2,655,503
1828	12,248	2,006,397	4,405	608,118	16,653	2,614,515
1829	12,636	2,063,179	5,094	730,250	17,730	2,793,429
1830	12,747	2,102,147	5,158	758,368	17,905	2,860,515
1831	13,791	2,300,731	5,927	896,051	19,718	3,196,782
1832	13,292	2,229,269	4,391	651,223	17,683	2,880,492
1833	13,266	2,244,274	5,250	758,601	18,516	3,002,875
1834	13,639	2,296,825	5,823	852,827	19,462	3,149,152
1835	13,948	2,419,941	6,047	905,270	19,995	3,325,211
1836	14,207	2,531,577	7,048	1,085,120	21,255	3,566,697

Statement of the shipping employed in the trade of the United Kingdom in the year 1836, exhibiting the number and tonnage of vessels that entered inwards (including their repeated voyages), with the number of their crews, separating British from foreign vessels, and distinguishing the trade with each country :—

COUNTRIES.	INWARDS. British. Ships.	Tons.	Men.	Foreign. Ships.	Tons.	Men.
Russia	1,611	322,133	14,471	274	65,735	3,087
Sweden	66	10,965	509	250	42,439	2,114
Norway	15	1,573	102	785	125,875	6,473
Denmark	16	2,152	111	694	51,907	3,192
Prussia	270	42,567	2,048	903	174,439	7,749
Germany	613	118,578	5,811	754	59,937	3,441
Holland	1,026	143,285	7,533	555	48,953	3,139
Belgium	501	51,522	4,453	409	49,185	3,043
France	2,036	198,339	16,561	1,740	108,352	11,417
Portugal, Proper	367	41,880	2,510	91	9,811	876
„ Azores	192	14,585	914	..	..	..
„ Madeira	16	3,418	254	..	..	..
Spain and the Balearic Islands	410	45,546	3,056	58	6,521	505
„ Canaries	29	2,682	153	4	385	41
Gibraltar	56	8,063	659	1	294	16
Italy and the Italian Islands	387	58,928	3,166	40	8,164	495
Malta	7	1,113	76	..	..	..
Ionian Islands	46	6,527	363	..	..	..
Turkey and Continental Greece	130	19,378	992	..	..	..
Morea and Greek Islands	15	2,252	112	..	..	..
Egypt	19	3,306	175	1	300	12
Tripoli, Barbary, and Marocco	26	3,127	160	..	..	..
Coast of Africa, from Marocco to the Cape of Good Hope	138	32,458	1,817	..	..	..
Cape of Good Hope	30	5,634	309	..	..	..
Eastern Coast, from the Cape of Good Hope to Bab el Mandeb	1	79	6	..	..	..
Cape de Verd Islands	..	..	..	..	..	..
St. Helena and Ascension	..	.	..	..	..	..
Madagascar	2	428	26	..	..	..
Mauritius	68	17,690	924	..	..	..
Arabia	3	569	41	..	..	..
East India Company's Territories, Singapore and Ceylon	227	97,034	5,788	.	..	..
Sumatra	..	..	..	..	..	..
Java	3	1,075	45	8	1,007	53
Other Islands of the Indian Sea, exclusive of the Philippines	..	..	..	..	..	..
Philippine Islands	5	1,212	65	..	..	..
Ports of Siam	1	337	18	..	..	..
China	80	40,686	2,530	..	..	..
New South Wales	59	19,195	1,015	..	..	..
New Zealand	1	363	20	..	..	..
British Northern Colonies	2,026	620,772	26,146	..	..	..
British West Indies	900	237,322	12,770	..	..	..
Hayti	3	471	27	..	..	..
Cuba, and other Foreign West Indies	31	5,667	305	12	2,595	112
United States	226	86,383	3,575	524	226,483	7,799
Mexico	31	5,343	285	2	425	22
Guatemala	5	731	43	..	..	..
Columbia	23	4,560	258	2	506	23
Brazil	201	45,833	2,272	3	619	32
States of Rio de la Plata	25	4,389	232	..	..	..
Chili	48	11,826	630	11	3,232	179
Peru	14	3,103	181	..	..	..
The Whale Fisheries	86	28 955	3.470	..	..	..
Isles of Guernsey, Jersey, and Man	2,256	130,944	10,602	13	1,735	101
Total	14,347	2,505,473	137,589	7,131	988,899	53,921

Statement of the shipping employed in the trade of the United Kingdom in the year 1836, exhibiting the number and tonnage of vessels that cleared outwards (including their repeated voyages), with the number of their crews, separating British from foreign vessels, and distinguishing the trade with each country :—

COUNTRIES.	OUTWARDS. British. Ships.	Tons.	Men.	Foreign. Ships.	Tons.	Men.
Russia	1,244	253,266	11,677	273	67,625	3,067
Sweden	65	10,561	509	204	28,138	1,515
Norway	17	1,600	114	820	137,606	6,892
Denmark	309	55,413	2,607	1,042	100,671	5,660
Prussia	212	32,518	1,608	680	135,049	5,918
Germany	660	126,157	6,144	781	57,661	3,508
Holland	945	139,172	7,263	576	51,853	3,515
Belgium	457	42,736	4,065	348	43,949	2,807
France	2,239	229,640	18,432	1,433	97,271	9,819
Portugal, Proper	324	38,272	2,478	103	15,755	1,017
„ Azores	144	10,564	766	18	2,004	173
„ Madeira	21	4,504	312	1	194	11
Spain and the Balearic Islands	318	36,239	2,591	58	9,032	545
„ Canaries	27	2,572	150	6	773	58
Gibraltar	162	20,814	1,365	4	1,064	54
Italy and the Italian Islands	359	54,095	3,027	62	12,881	731
Malta	80	11,626	649	1	190	12
Ionian Islands	31	6,182	358	..	..	..
Turkey and Continental Greece	156	26,632	1,452	2	580	28
Morea and Greek Islands	3	367	22	..	..	..
Egypt	44	7,879	418	..	..	..
Tripoli, Barbary, and Marocco	26	4,251	215	10	2,988	136
Coast of Africa, from Marocco to the Cape of Good Hope	174	42,671	2,429	1	92	10
Cape of Good Hope	70	14,910	841	..	..	..
Eastern Coast, from the Cape of Good Hope to Bab el Mandeb	1	235	11	..	..	..
Cape de Verd Islands	2	472	26	..	..	..
St. Helena and Ascension	5	967	54	..	..	..
Madagascar	1	258	12	..	..	..
Mauritius	66	18,576	1,016	..	..	..
Arabia	6	692	100	..	..	..
East India Company's Territories, Singapore and Ceylon	267	117,784	7,224	..	..	..
Sumatra	1	279	16	..	..	..
Java	13	4,056	214	4	1,148	73
Other Islands of the Indian Sea, exclusive of the Philippines	1	221	13	..	..	..
Philippine Islands	2	488	36	..	..	..
Ports of Siam	..	..	..	..	..	..
China	38	24,099	1,589	12	4,885	227
New South Wales	107	36,788	2,204	..	..	..
New Zealand	..	..	..	..	..	..
British Northern Colonies	1,863	514,903	24,643	..	..	..
British West Indies	892	238,915	13,267	..	..	..
Hayti	38	5,937	321	..	..	..
Cuba, and other Foreign West Indies	75	15,303	834	20	4,617	271
United States	339	128,856	5,714	579	255,046	9,653
Mexico	21	3,880	241	..	..	..
Guatemala	3	456	24	..	..	..
Columbia	8	1,486	82	1	253	13
Brazil	216	50,370	2,569	5	2,839	285
States of Rio de la Plata	26	7,441	386	1	163	10
Chili	27	6,139	366	1	153	12
Peru	18	3,718	226	..	..	..
The Whale Fisheries	94	31,589	3,990	1	500	40
Isles of Guernsey, Jersey, and Man	1,990	115,028	9,596	1	140	9
Total	14,207	2,531,577	144,295	7,048	1,035,120	56,069

Education.—The statistics of education have hitherto been very imperfectly collected in England. In May, 1833, an address to the crown was voted by the House of Commons for returns upon this subject, which should embrace schools of all descriptions in England and Wales. Considerable care was taken by Mr. Rickman, of the House of Commons, the gentleman who has so well managed the population returns, to obtain the fullest and most accurate answers to questions that were circulated throughout England and Wales, with the view of ascertaining the means provided for instruction, but there is little doubt that the returns obtained were exceedingly incomplete. They present however the best statistical view we have of this important object, and will be useful in the absence of more accurate statements. Whatever errors are exhibited in the following abstract are all on the side of omission.

As the superintendence of education is no part of administration in England, there are no means of ascertaining its condition except by a laborious collection of scattered materials The ten volumes of the 'Quarterly Journal of Education, published by the Society for the Diffusion of Useful Knowledge, supply some information on the state of education in the universities of Oxford and Cambridge, and the grammar and other schools of England. The Reports of the Commissioners to inquire into Charities in England and Wales, the first and second volumes of the Central Society of Education, the Reports of the National School Society, of the British and Foreign School Society, and those of various religious and benevolent societies, will furnish much valuable information on the subject. The conclusion which, we believe, may be fairly deduced from these materials is this :—that education, both general and professional, is in a condition below what the interests of the community require; that the exertions of societies and individuals within the present century have done much for its improvement; that the means for further improvement are ample; and that nothing is wanted but a Minister, worthy of the task, to unite and direct the energies of the nation towards the perfecting of this, the most important of all the branches of Administration

	ENGLAND.		WALES.		TOTAL.	
	Schools.	Scholars.	Schools.	Scholars.	Schools.	Scholars.
Infant Schools	2,932	87,139	53	1,866	2,985	89,005
Daily Schools	34,610	1,134,998	1,376	52,944	35,986	1,187,942
Total . .	37,542	1,222,137	1,429	54,810	38,971	1,276,947
Maintenance of Infant and Daily Schools:—						
By Endowment	3,914	146,121	192	7,643	4,106	153,764
By Subscription	2,714	170,494	115	8,023	2,829	178,517
By Payments from Scholars	28,138	700,672	1,003	31,777	29,141	732,449
By Subscription and Payment from Scholars	2,776	204,850	119	7,367	2,895	212,217
Sunday Schools	14,929	1,375,719	1,899	173,171	16,828	1,548,890
Maintenance of Sunday Schools:—						
By Endowment	544	37,804	27	1,729	571	39,533
By Subscription	13,439	1,256,468	1,805	166,909	15,244	1,423,377
By Payments from Scholars. . . .	79	4,282	22	1,436	101	5,718
By Subscriptions & Payments from Scholars	867	77,165	45	3,097	912	80,262
Schools established by Dissenters:—						
Infant and Daily Schools	827	48,471	98	3,351	925	51,822
Sunday Schools	4,910	618,770	1,337	131,337	6,247	750,107
Increase of Schools between 1818 and 1833:—						
Infant and Daily Schools.	18,997	647,034	648	24,209	19,645	671,243
Sunday Schools	9,687	974,634	1,598	148,763	11,285	1,123,397
Schools to which lending Libraries are attached	2,431		33		2,464	

Returns were made to the House of Commons by the sheriffs of counties in Scotland, showing the number of scholars receiving instruction in the Scottish parochial schools, and the number of schools not parochial, with the number of scholars taught therein in 1825. These returns embraced 905 out of 930 parishes, and exhibited the following result:—

Number of scholars in parochial schools .	56,232
Schools not parochial:—	
Number of schools	2,402
Number of scholars	10[illegible],495

Further returns were called for in 1834, and very voluminous statements have been presented to Parliament in consequence. The result of these statements is given in the following abstract:—

	Males.	Females.	Total.
Children taught to read:—			
Under 5 years of age .	8,584	7,699	16,283
From 5 to 15 years .	126,796	98,461	225,257
Total taught to read	135,380	106,160	241,540
Children taught to write:—			
From 5 to 15 years of age	70,683	43,943	114,626

On the state of university and school education in Scotland the reader is referred to the *Journal of Education*.

Army.—The number and description of the land-forces in the service of the country at the beginning of 1838 were as follows:—

Description of Corps.	Number of Corps or Regiments.	Horses.	Officers.	Non-Commissioned Officers, Trumpeters, and Drummers.	Rank and File.	Total.
CAVALRY.						
Life Guards and Royal Horse Guards . .	3	822	96	159	1,053	1,308
Cavalry of the Line . .	23	8276	713	866	8,578	10,157
INFANTRY.						
Foot Guards .	3	..	218	395	4,640	5,253
Regiments of the Line . .	100	..	4313	5931	76,117	86,361
West India and other Colonial regiments .	8	200	317	403	5,228	5,948
Total . .	137	9298	5657	7754	95,616	109,027

This force was distributed as follows:—

In Great Britain	24,113 rank and file.
Ireland	19,766 "
Abroad, exclusive of India .	34,449 "
In India	17,288 "
	95,616

Navy.—The number of persons employed in the naval service of the public at the same period was—

Flag-officers in commission and their retinue .	151
Officers superintending dock-yards . .	8
Captains in commission	58
Commanders	67
Lieutenants	390
Masters, chaplains, surgeons, and pursers .	670
Gunners, boatswains, carpenters, and engineers	700
Mates, midshipmen, clerks, &c.	1,899
Petty-officers	4,799
Seamen	11,694
Royal Marine corps . . .	9,026
Total	29,462

The numbers of ships and vessels of war in commission at different periods during the war were—

February, 1797	.	459,	and 39 stationary ships.
" 1813	.	535,	67 hired cutters, troop-ships, and stationary ships.
" 1815	.	403,	33 troop-ships and stationary ships.

The number of vessels belonging to the British navy on the 1st of April, 1838, was 578, including 12 packet-brigs and 26 mail steam-vessels. Of these there are in commission 219 vessels of all sizes, including 42 steam-vessels, 26 of which are employed as mail-boats. There are besides in commission 48 revenue vessels, one of which is a steam-vessel.

Government and Administration.—The English form of government is generally called a limited or constitutional hereditary monarchy; but this is an imperfect and inaccurate description. The sovereign power may be considered as residing in three bodies or estates—King, Lords, and Commons. These three estates constitute the parliament, and the concurrence of these three limbs or members of the sovereign power is necessary for enacting, annulling, or altering any law. The House of Lords consists of the temporal peers of England, the elective peers of Scotland and Ireland, the bishops of England, and four Irish lords spiritual, who sit by rotation of sessions. The House of Lords is also the Supreme Court of Appeal for Great Britain and Ireland.

Since the Union with Ireland in 1801 the House of Commons has comprised 658 members, of whom there are—

For England,—County Members		143	
Universities		4	
Cities and Boroughs		324	
			471
Wales,—County Members		15	
Cities and Boroughs		14	
			29
Scotland,—County Members		30	
Cities and Boroughs		23	
			53
Ireland,—County Members		64	
University		2	
Cities and Boroughs		39	
			105
			658

Under the articles PARLIAMENT, BOROUGHS, COMMONS (HOUSE OF), the constitution of these several bodies is fully described.

The administration is entrusted by the king to certain great officers of state, usually from 12 to 14 in number, who together form what is called the Cabinet. The First Lord of the Treasury is generally considered the Prime Minister. The usual members of the Cabinet are, besides the Prime Minister, the Chancellor of the Exchequer, the Lord President of the Council, the Lord High Chancellor of England, the Lord Privy Seal, the three Secretaries of State, the First Lord of the Admiralty, the President of the Board of Trade, the President of the Board of Control for the Affairs of India, the Secretary at War, and the Chancellor of the Duchy of Lancaster.

The superior courts for the administration of justice are the High Court of Chancery; the Court of Exchequer; the Court of Queen's Bench, which is the highest Common-law and Criminal Court in the kingdom; and the Court of Common Pleas. Besides these there are many inferior courts with local jurisdiction. Courts of assize are held by the judges in every county of England and Wales, for which purpose the country is divided into eight circuits. The judges of the superior courts are in all cases appointed by the crown for life, and are removeable only upon an address from parliament to the crown. The constitution of these several courts is described under the heads of CHANCERY, CIRCUITS, COURTS, EXCHEQUER, &c.

The constitution of the courts of SCOTLAND is explained under that head.

England and Wales are ecclesiatically divided into two provinces—York and Canterbury—containing 24 bishoprics or dioceses, besides that of the Isle of Man. Every parish is under the spiritual charge of a clergyman, who is either rector, vicar, or perpetual curate. Each parish has the management of various matters relating to its own concerns, the inhabitants meeting together in a body, or by a certain number selected from the general body, for the purpose of levying rates for the support of the poor and for other local purposes. Certain officers are chosen annually by the rate-payers to superintend the distribution of these funds. [BISHOPRIC; CLERGY; PARISH; &c.]

Literature.—Under this head we propose to give such a brief account of the literature existing in each of the languages that is or has been spoken in the United Kingdom, as shall present a synoptical view of the whole subject, and at the same time serve for an index to the articles in which the several writers are separately treated of.

1. The Irish language. This is generally admitted to be the purest form of the Celtic speech, which appears to have at one time been common to all the inhabitants of both islands. The Irish, as is well known, is still a spoken language. The oldest Irish manuscript, a collection of bardic legends called the 'Psalter of Cashel,' compiled by Cormac MacCulinan, bishop of Cashel and king of Munster, is believed to be no older than the latter part of the ninth century; but some of the bardic compositions that have been preserved in this and other records are supposed to be of much higher antiquity; though doubtless, if they are so, they must have been greatly altered from their original form before being committed to writing. The national chronicles pretend to furnish a list of the names of the bards from about the first century of the Christian æra; and some of the fragments of their compositions that have come down to us are assigned to so early a date as the fifth century. Of the remains of the antient Irish literature, however, by far the most valuable are the prose records of Tigernach and the other annalists, which appear to have been written in the 11th and 12th centuries, but profess to be compiled from documents of much earlier date. The chief antient Irish annalists have been published in the original, accompanied with a Latin translation, by the late Rev. Dr. Charles O'Connor, in his 'Rerum Hibernicarum Scriptores Veteres,' 4 vols. 4to., Buckingham, 1814—1826. This learned and elaborate work may also be consulted for a general account of the existing antient Irish manuscripts. A long list of the Irish annalists is given in Bishop Nicholson's 'Irish Historical Library,' chapter ii. The largest collections of Irish manuscripts are those in the libraries of Trinity College, Dublin, and of the Duke of Buckingham at Stowe. Of the few works that have appeared in Irish in recent times, the most remarkable are Keating's 'History of Ireland,' which was afterwards translated into English by Dermot O'Connor, and the translation of the Bible. The Irish language however was at no time studied by the scholars of any other country; and most of the learned accordingly, in Ireland as in the other countries of Europe, formerly wrote in Latin. Among the early Latin writers whom Ireland has produced, and whose works have in whole or in part come down to us, may be mentioned the heretics Pelagius and his disciple Celestius, in the fourth century; the national apostle St. Patrick, his friend bishop Secundinus, and the poet Sedulius, or Shiel (as his real name is supposed to have been), in the fifth; St. Columbanus, St. Cummian, and Cuminius and Adomnan, the two biographers of St. Columba, in the seventh; Alcuin, the friend of Charlemagne (although he is also claimed as a countryman by the English and the Scotch), in the eighth; Dungal, another Sedulius, who wrote on religious subjects in prose, Donatus, the bishop of Fiesole, and the celebrated Joannes Scotus Erigena, in the ninth. The natives of Ireland who in modern times have written either in Latin or in English, and among whom are some of the most distinguished names of which our literature has to boast, must be considered, in their literary capacity at least, as Englishmen.

2. The Gaelic, or Celtic of Scotland. This is also still a spoken language. It is a sister dialect of the Irish, which it so much resembles that the Bible and a few other books in Irish were, till very recently, the only printed literature which the Gael of Scotland possessed. It is believed that not even a manuscript in Gaelic exists which is older than the 15th century, although some of the compositions in verse which have been preserved in the language may be of greater antiquity. The celebrated poems of Ossian appear to be founded upon the compositions of Irish bards who lived in the 11th and 12th centuries. The Gaelic originals, so far as they exist, of the productions published by Macpherson under this title, have been printed with a literal Latin translation by the Highland Society of Scotland; and, besides a few grammars and dictionaries, there now also exist in a printed form Gaelic translations of the Bible, of the Psalms in verse, and of a very few English works, mostly religious.

3. The Manks, or language of the Isle of Man. This is another dialect of the Celtic. Formerly, at least, the language of the northern half of the island more resembled the Scottish Gaelic; that of the south, the Irish. (See Letter from John Meryk, bishop of the see, in Camden's *Britannia.*) The Bible, the English Prayer-Book, and a few religious tracts are almost the only works that have been printed in the Manks.

4. The Welsh. The remains which we possess of the antient Welsh literature are very considerable, both in quantity and value. They consist chiefly of the poems of the bards, of the collections of verses called Triads, of the Bruts, or Chronicles, and of some early laws. The four principal and most antient Welsh bards are Aneurin, Taliesin, Llywarch Hen, and Merlin, or Merdhin, the Caledonian, who are all believed to have flourished in the sixth century. The other antient bardic remains extend over the five following centuries. The Triads are collections of metrical triplets, for the most part commemorative of historical events, which appear in their present form to be a compilation of the 13th century, though founded on earlier records now lost. The Triads and the principal bardic remains have been printed in the original in the 'Myrvyrian Archæology of Wales,' 3 vols. 8vo., Lond. 1801. Two very curious collections of old Welsh fictions however still remain for the most part in manuscript: the 'Mabinogion' (said to mean 'amusements for youth'), of which only some short specimens have appeared in the 'Cambro-Briton,' the

'Cambrian Register,' and the 'Cambrian Quarterly Magazine;' and the 'Damhegion,' consisting of Fables in the manner of Æsop, which were translated and prepared for the press by Mr. Evan Evans, but have never yet been printed either in English or in the original. The most antient and famous of the existing Welsh chronicles is that of Tysilio, who appears to have flourished in the seventh century. It is printed in the original in the 'Archæology of Wales,' and there is also an English translation of it by the Rev. Peter Roberts, 8vo., Lond. 1810. The remains of the antient Welsh laws, the most important of which are those enacted by Howel Dha, prince of South Wales, in the early part of the tenth century, have been printed by Wotton in his 'Leges Wallicæ,' fol., Lond. 1730. With the exception of a short revival of the old poetic spirit in the latter part of the 14th century, the most remarkable product of which was the poetry of Davyth ap Gwilim (of which some specimens have lately been presented in an English dress, 12mo., Lond. 1834), there has been little literary cultivation of the language of Wales since the country became incorporated with England. The Bible however and some religious works have been translated into Welsh in modern times. In early times the Welsh scholars, as well as their contemporaries in other countries, wrote in Latin; but Wales cannot enter into competition with Ireland either in the number of its learned men in the Middle Ages, or in their individual eminence. The most memorable of the Welsh writers in Latin are the monkish chroniclers Gildas and Nennius, of the seventh century, and Giraldus Cambrensis and Geoffrey of Monmouth, who both lived in the 12th.

5. The Cornish. The Cornish was a spoken language little more than a century ago, but is believed to be now altogether lost, with the exception of the Lord's Prayer and the Creed (which are given by Camden), and a short vocabulary collected by Dr. Borlase in his 'Antiquities of Cornwall,' folio, 1754 and 1769. From these specimens it appears to have been a sister dialect of the Welsh. If any literary compositions ever existed in Cornish, they have wholly perished.

6. The Norse. This is the name given to the tongue that used to be spoken by the people of the Orkneys, and that perhaps is not yet altogether extinct there. It is, or was, a Gothic dialect; but we are not aware that any composition in it exists, with the exception of a version of the Lord's Prayer, first given by the Rev. Dr. James Wallace, a clergyman of these islands, in his 'Account of the Orkneys,' 8vo., London, 1700; and which may also be found in Chamberlayne's 'Oratio Dominica omnibus fere in Linguis;' in Bishop Percy's preface to Mallet's 'Northern Antiquities;' in Pinkerton's 'Inquiry into the (Early) History of Scotland;' in Sir Robert Sibbald's 'History of Fife,' notes to Cupar—Fife edition, 8vo., 1803; and elsewhere.

7. The Anglo-Saxon. If we disregard the opinion which supposes a Teutonic tongue, identical with or nearly resembling the Anglo-Saxon, to have been brought over to the south of Britain by the Belgic colonists that had settled in the country before the arrival of Cæsar [ENGLAND], the period during which the Anglo-Saxon was the spoken language of that part of the island, or rather indeed of the whole island from the Channel to the Forth, with the exception of the stripe along the west coast, which continued to be occupied by the Welsh and other apparently cognate tribes, may be rudely defined as extending from the settlement of the Angles and Saxons about the beginning of the sixth century to the close of the twelfth. We possess a series of Anglo-Saxon literary compositions in prose and verse, from at least the latter part of the seventh century; and although the earlier specimens are both scanty and, in all probability, considerably corrupted, those of later times have come down to us in ample quantity, and to a great extent in perfect preservation. Here we can mention only the names of the principal writers in each department; referring the reader who is desirous of more minute information to the detailed catalogue of Saxon manuscripts drawn up by Humphrey Wanley, which forms the third volume of Hickes's 'Thesaurus Linguarum Septentrionalium,' fol., Oxon., 1705. In Anglo-Saxon poetry, the most remarkable productions that have come down to us are the poem on the exploits of Beowulf the Dane, which appears to be the most antient Anglo-Saxon composition extant; the Metrical Paraphrase of various parts of the Scriptures, attributed to a writer of the name of Caedmon, who however is of later date than the Caedmon of whose poetry Bede has preserved a short fragment; and the poem preserved in the Saxon Chronicle on the victory obtained by king Athelstan over the Hiberno-Danish chieftain Anlaf, and his ally Constantine king of the Scots, in 938. To these may be added, as written in a language still rather Saxon than English, though in the reign of Henry II., Layamon's translation of the French Brut, or chronicle, of Wace of Jersey; the paraphrase of the Gospel Histories, entitled 'Ormulum;' and even the romance called the 'Geste of King Horne,' although that is often referred to as the earliest English romance. Many shorter pieces of Anglo-Saxon poetry of every age have also been preserved. A manuscript volume of Anglo-Saxon poetry, which has been preserved in the cathedral of Exeter since the Norman conquest, is understood to be now preparing for publication by Mr. Thorpe, the editor of Caedmon's Paraphrase of the Scriptures. The principal prose writings of the Anglo-Saxon language consist of the Saxon Chronicle, the first part of which, chiefly translated from Bede, was probably drawn up in the tenth century, and which was continued by a succession of contemporary annalists to the death of Stephen in 1154; translations of parts of the Scriptures, homilies, lives of saints, and other theological compositions, by various hands; the grammatical tracts of Archbishop Aelfric; fragments of the laws of various Saxon kings from Ethelbert of Kent, who flourished in the beginning of the seventh century, to Canute inclusive, published by Lambard, 1568, by Whelor, 1644, and by Wilkins, 1722, together with numerous decrees and canons of councils, charters, and other legal documents, most of which remain in manuscript; and, above all, the various works attributed to king Alfred, including translations of Bede's Ecclesiastical History, of Boethius's Treatise on the Consolation of Philosophy, of a tract of Pope Gregory I., De Cura Pastorali (on the Pastoral Office), and of the Geography of Orosius; all, especially the Boethius and Orosius, comprising more or less original matter added by the translator. Of the Anglo-Saxon authors who have written in Latin, and whose works or any of them have been preserved, the chief are the venerable Bede, or Beda, in the seventh century, the author of the Ecclesiastical History of his own nation, and of other works which fill eight volumes folio; his contemporaries Aldhelm, abbot of Malmsbury, and afterwards bishop of Sherborn, the author, besides several prose treatises, of a curious poem of considerable length on the virtue of Virginity; St. Boniface, the celebrated missionary of Christianity to the Germans, St. Cuthbert, and Eddius Stephanus, the author of a life of Bishop Wilfrid; Asser, the biographer of Alfred, in the tenth century; and in the eleventh the historian Ingulphus, the abbot of Croyland, if indeed the history that bears his name be really a composition of that age, which there seems to be some reason to doubt. Eadmer, and the other Latin chroniclers who wrote during the first century and a half after the Norman conquest, although some of them were of Saxon descent, may more properly be noticed under the next head as English writers. Many laws, canons of councils, charters, and other public or legal documents, belonging to the Saxon period, especially those relating to the affairs of the church, are also in Latin.

8. The English language. We cannot here attempt any detailed account of the formation and progress of the English language; but we may note the great epochs of its history, from its rise out of the Saxon in the twelfth century to its settlement into the form in which it now exists.

For the first century after the Conquest, as already observed, the language of the body of the nation continued to be Saxon, substantially of the same character with that which had for ages before been spoken by their ancestors. The transmutation of the Saxon into English appears to have been principally effected by the intermixture of the conquered people and their conquerors, which began to take place in the twelfth century. Had the English been left to themselves there seems to be no reason to suppose that they would ever have either abandoned or corrupted the tongue of their forefathers. The corruption of the Saxon, a language of a pure Teutonic lineage and character, and refined to a high degree of grammatical complication and artifice, into the inarticulate chaotic jumble which about this time began to take its place, must have been the work, not of those to whom it was vernacular, but of the foreigners who, in endeavouring to speak it, naturally mixed it with the vocables, and meta-

morphosed it by the imposition of the grammatical forms of their native tongue. In other words, it must have been the Normans that broke down the Saxon into English This view is confirmed by three remarkable facts: first, that the change took place at the very time when, according to the testimony of contemporary writers, the two races, that had till now had little association with each other, began to intermix; secondly, that one of the accompaniments or characteristics of the change was the infusion into the old Saxon of many Norman or French vocables; thirdly, that its other characteristic or constituting circumstance was the substitution of the very grammatical forms which were already in use in the French language, namely, the method of separate particles and auxiliaries, for that of inflection. No reason can be assigned why the Saxons themselves should have adopted either of these innovations; they could only have come from the Normans. To them therefore we must attribute the creation of our modern English tongue, which, although to a great extent founded upon the Saxon, and also retaining much of its genius and character, yet wholly differs from it in two important respects; first, that in its vocabulary it is a very mixed, instead of a comparatively pure language; secondly, that its grammatical structure proceeds, as just explained, upon a wholly opposite principle to that which prevailed in the Saxon. The antient forms of the language however were by no means at once thrown off, and in some respects what may be called its transition state from Saxon to English may be said to have lasted till the middle of the fifteenth century; but although down to that comparatively recent date it still retained in its general structure various Saxonisms which are now obsolete, these remnants of its pre-existing shape and constitution had been gradually dropping off for at least a hundred years preceding. Dating then the dissolution of the Saxon and the birth of the English from the middle of the twelfth century, we may say that the language continued still as much Saxon as English to the middle of the fourteenth. It was nearly two centuries more before the Saxon peculiarities that refused to assimilate with the new forms had altogether disappeared. Before the middle of the sixteenth century however the language had assumed throughout very nearly the structural character which it still retains; it has been constantly indeed receiving accessions to its vocabulary down to the present hour, but in other respects the variations it has undergone from that date amount properly only to changes of style, not of structure. It was in all its essential characteristics the same language in the reign of Henry VIII. that it is now.

This much being premised, we shall now subjoin the names of the principal English writers in each of the great departments of literature, arranging them chronologically, and marking the centuries in which they severally lived. It is, of course, the principal names only that can be enumerated within our limits.

In poetry the literature of England is perhaps richer than any other of antient or modern times; certainly, at least, the Greek and the German alone have any pretensions to compete with it. This is also the department of our literature upon the history of which the greatest attention has been bestowed; although the labours of Warton, of Percy, of Johnson, of Ritson, of Ellis, of Campbell, and of a host of editors who have appeared within the last seventy or eighty years, have still left a considerable portion of the subject imperfectly surveyed. The history of the origin and progress of the English drama has already been fully detailed under that head; but some of the most eminent of our dramatists were also eminent in other kinds of poetry, and their names will therefore again claim mention here. If we were in our enumeration to confine ourselves rigidly to great writers, whose works have secured an enduring popularity or reputation, we should have no name of any poet to record during the two first centuries after the date that has been assigned as that of the birth of the English language. In tracing the progress of the language, however, our earliest versifiers derive from their position a claim to commemoration which the value of their works would not give them. On this account we may begin with three or four names belonging to the latter part of the thirteenth and the earlier part of the fourteenth centuries:—Robert of Gloucester, the author of a metrical chronicle, which is mostly a translation from the Latin of Geoffrey of Monmouth; Robert Mannyng, otherwise called De Brunne (from the abbey of that name in Lincolnshire, of which he was a monk), the author of another work of the same kind translated from the French; Adam Davy, the author of some devotional poems; the writer of the Romance called 'The Life of Alexander;' and Lawrence Minot, the author of a series of poems on the warlike exploits of Edward III., which are distinguished by considerable gleams of poetic spirit, but are more remarkable for the improved state in which they exhibit the language as compared with the form in which it is presented in the works of preceding writers. These were followed soon after the middle of the fourteenth century by Robert or William Langland, the author of the very vigorous satire entitled 'The Visions of Pierce Ploughman.' Contemporary with Langland, though he probably outlived him, was the illustrious Geoffrey Chaucer, the true Homer of our English poetry. The century and a half that followed the extinction of Chaucer produced no great poet, but many versifiers, several of whom however contributed their share to the improvement of the language, if they did not enrich it with any compositions of much value. At their head may be placed John Gower, who, although he was the contemporary of Chaucer, appears to have survived him some eight or ten years. Of those that followed the names of three or four only are deserving of being remembered out of about seventy that the antiquarians have disinterred:—Thomas Occleve, who represents himself as the pupil of Chaucer; the fluent and voluminous John Lydgate, the monk of Bury; Stephen Hawes, who flourished in the reign of Henry VII.; his contemporary, Alexander Barklay, the author of the 'Ship of Fools,' which is, for the greater part, a translation from the celebrated German satire by Sebastian Brandt; and John Skelton, the coarse satirist of the early part of the reign of Henry VIII.

A new æra, both in our poetry and in the language, is marked by the poems of Sir Thomas Wyatt and Henry Howard, earl of Surrey, in the latter part of the same reign. The next eminent name that occurs is that of Thomas Sackville, lord Buckhurst and earl of Dorset, the author of the 'Induction' and of the 'Legend of Buckingham,' in the famous collection of poems upon the more striking passages of English history, entitled the 'Mirror for Magistrates.' Sackville was the worthy precursor and herald of Edmund Spenser, the second in the order of time among the chief glories of our poetry. Spenser again may be regarded as ushering in the splendid train of the poets of the age of Elizabeth and James, among which the most eminent names, besides those of Shakspeare and the other dramatists, are George Chapman, the translator of Homer; the satirist, Joseph Hall, successively bishop of Exeter and Norwich; Joshua Sylvester ('the silver-tongued Sylvester,' as he was called), the translator of the works of the French theological poet Du Bartas, and, although ranking higher for sound than sense, honoured, it is said, by the admiration of the young genius of Milton; the elegant Samuel Daniel, and the learned Michael Drayton, the two historical poets of their country; Giles and Phineas Fletcher, the cousins of the celebrated dramatist; the philosophical Sir John Davies; Edward Fairfax, the melodious translator of Tasso; Dr. John Donne; George Herbert; Thomas Randolph; Thomas Carew; and William Drummond, of Hawthornden, who may be considered as the first Scotsman that wrote with any success in the dialect of the southern part of the island after it had become distinct from that of his native country. We have of course omitted in our enumeration, besides the dramatists, many names that are familiar to the students of our old poetry, but the poetic renown of which has now nearly or altogether passed away from the popular remembrance. As forming a continuation of the same bright galaxy, and extending it over the middle portion of the seventeenth century, may be mentioned Richard Lovelace, Sir John Suckling, Robert Herrick, Sir Richard Fanshawe, Sir William Davenant, Sir John Denham, George Wither, Andrew Marvell, Abraham Cowley, Samuel Butler, and, by far the greatest in the list, John Milton, the fourth illustrious name that stands in the front rank of the array of the English poets, along with those of Chaucer, Spenser, and Shakspeare. All these writers were by no means of one school, any more than they were of one character of genius; but still the poetry of all of them may be said to preserve under various modifications the same fundamentally English tone and spirit. After the Restoration a new kind of poetry arose among us, which was mainly an imitation of the French, and was distinguished from all that

had preceded it in the English language, by taking its animation not so much from imagination and sentiment, as from wit, levity, and a polished facility. Edmund Waller, Sir Charles Sedley, Wentworth Dillon, earl of Roscommon, Charles Sackville, earl of Dorset, and Matthew Prior, may be noted as the most eminent leaders in this new style, which however was cultivated by a long line of their followers, whose example continued powerfully to influence our poetry down to the close of the last century. This period however, besides producing in the drama the fervid Lee and the pathetic Otway, is also that of the vigorous and impetuous Dryden, certainly one of the greatest masters of eloquence in rhyme the language has to boast of. Parnell, Garth, Addison, and Congreve, are the chief names that fill up the interval between Dryden and his great successor Pope. To these may be added Pope's contemporaries, Gay and Swift. For two-thirds of a century after he rose into fame, Pope was the god of all the imitators. Several poets of true genius, however, and of more or less originality, also arose during this period, the most distinguished of whom were Young, Thomson, his countryman Blair, the author of 'The Grave,' Joseph and Thomas Warton, Collins, Shenstone, Churchill, Gray, Akenside, Armstrong, Goldsmith, Beattie, Johnson, Mason, and Darwin, writers indeed of very unequal powers, as well as exceedingly diverse in character, but each, even the least, possessing something that is unborrowed and his own. Cowper however has the best title to be regarded as the restorer among us of a more natural poetry than that style which the brilliant success of Pope had so long established in the general opinion as the highest model. He may be held to have been the forerunner, though by no means the chief leader or exciting example, of the succession of great writers who within the last half century have so remarkably revolutionized our poetry, producing something like a revival of its Elizabethan spring, including Coleridge, Shelley, Keats, Scott, Byron, Crabbe, and others who still live.

Along with the poets may be enumerated the principal writers in the department of prose fiction. This is a field that has only been cultivated among us with much success in comparatively recent times. Of the old English prose romances, the only one that is now generally remembered is the 'Arcadia' of Sir Philip Sidney. Along with that perhaps may be mentioned, as also a sort of poem in prose, which still enjoys great popularity, the 'Pilgrim's Progress' of John Bunyan. The principal modern English novelists are Defoe, Swift, Richardson, Fielding, Smollett, Sterne, Goldsmith, Moore, Holcroft, Mrs. Radcliffe, Mrs. Barbauld, Mrs. Opie, Miss Austin, Maturin, Scott, and various living writers of both sexes.

English eloquence, at least in so far as it has been preserved, is also a part of our literature that is chiefly of modern growth; for although Sir Thomas More, Lord Chancellor Bacon, and other eminent men of former times, are celebrated for their oratorical powers, we possess scarcely any of their harangues in the state in which they can be conceived to have been actually delivered. Certainly of their extemporaneous speaking, the only kind of oratory that stands by itself as a distinct thing from written composition, we have no trustworthy example. The specimens of English oratory that have been preserved in any tolerably satisfactory form, hardly go back beyond the middle of the last century. From that date however there exists a voluminous collection of the speeches, more or less perfectly reported, in parliament and at the bar, of Burke, Fox, the younger Pitt, Sheridan, Erskine, Flood, Grattan, Curran, Wyndham, Canning, and others. It is remarkable how large a proportion of these great speakers have been natives of Ireland, and that Lord Erskine is the single Scotchman in the list.

In theology, metaphysical and ethical disquisition, politics, criticism, æsthetics, and moral speculation generally, the most eminent English writers are the following:—in the fourteenth century, Wyclif, the translator of the Bible, and the author of many theological treatises in the mother-tongue; and Chaucer, who translated Boethius, and one of whose Canterbury Tales is a moral discourse in prose: in the sixteenth, Sir Thomas More, Sir Thomas Elyot, Sir Philip Sidney, George Puttenham (the author of a critical work on the 'Art of Poesie'), Roger Ascham, Bishops Latimer, Jewel, and Andrews, and the classic Hooker: in the seventeenth, Bacon, Milton, Dryden, Cowley, Hobbes, Harrington, Nevile, Algernon Sidney, Chillingworth, Cudworth, Henry More, Norris, Sir Thomas Brown, Jeremy Taylor, Barrow, Thomas Burnet, Tillotson, Leighton, Richard Baxter, Locke, and South: in the eighteenth, Steele, Addison, Swift, Mandeville (author of the Fable of the Bees), Lord Bolingbroke, Bishops Berkeley, Butler, Sherlock, Warburton, Hurd, Lowth, and Cumberland, Jortin, Hutcheson, Hartley, Lord Kaimes, Adam Smith, David Hume, Burke, Johnson, Hawkesworth, the unknown author of the 'Letters of Junius,' Reynolds, Reid, and Paley: in the nineteenth, Bentham, Ricardo, Dugald Stewart, Mackintosh, Mill, Archbishop Magee, Malthus, &c. To these might be added several writers of letters, which have not in all cases been intended for the press; such as Howell, Lord Chesterfield, Lady Mary Wortley Montagu, Horace Walpole, Cowper, &c. Many of these letters however partake of a historical, biographical, or otherwise narrative character.

In the great department of history, although the mass of printed matter that exists in the language is of considerable volume, the English works constructed on principles of high art are, as in all other languages, very few in number. If we except some comparatively short pieces by Sir Thomas More, Lord Herbert, Bacon, Sir William Temple, Swift, and a few other older writers, our great historical works of a classical character will be all comprised in the following short list:—Sir Walter Raleigh's 'History of the World;' Lord Clarendon's 'History of the Grand Rebellion;' Hume's 'History of England;' Robertson's Histories of Scotland and of Charles V.; and Gibbon's 'History of the Decline and Fall of the Roman Empire.' Along with these however may be mentioned the old chroniclers, as they are commonly designated, of the fifteenth and sixteenth centuries, whose narrative is often marked by a simplicity, directness, and homely graphic power, that give them a claim to be considered as forming an integral part of the national literature; the chief of them are, in chronological order, Trevisa, Caxton, Fabyan, Hall, Grafton, Holinshed, Stow, and Speed. To these may be added Fox, the martyrologist. Of later recorders of the events of their own times, memoir-writers, anecdote-collectors, biographers, &c., the list would be a very long one; we may mention Fuller, Strype, Mrs. Hutchinson, Bishop Burnet, the Duchess of Marlborough, Granger, and Walpole, as among those most marked by piquancy or individuality of character. In literary history, almost the only great work we possess, and even that is unfinished, is Warton's 'History of English Poetry.'

These classes will comprehend nearly all that can be properly called the literature of any country. As for works on the mathematical and natural sciences, on mere professional subjects, on the arts of life, on statistics, geography, topography, and antiquities, and even narratives of voyages and travels, they are usually no more any part of the literature of a language than are our grammars and dictionaries, or the statutes at large. With a few rare exceptions, there is nothing in such works that connects them with the language; they are perfectly translatable into any other language; their value consists in the information they contain, and the method according to which it is arranged and expounded, and very little, if at all, in their execution as pieces of writing. Newton's 'Principia,' for instance, is precisely the same book in Latin as in English, and in English as in Latin. Even such a work as Blackstone's 'Commentaries,' in which there is some ambition of rhetoric, would hardly, in a good translation into another language, lose any part of any one of the qualities for which it is held in esteem. Not so any great work in poetry, in history, in eloquence, or in any department of the belles-lettres: Homer, Plato, Aristophanes, Demosthenes, Lucretius, Livy, Dante, Froissart, Montaigne, Cervantes, Schiller, Goethe, Chaucer, Spenser, Shakspeare, Milton, Taylor, Burke, are all essentially untransferable in their whole substance and spirit into any other tongue.

Nor do the productions of those Englishmen who have written in Latin properly belong to English literature. The only names of writers of this class therefore that need be here noticed are those of some of the antient national historians or annalists who preceded those chroniclers in the mother-tongue that have been already mentioned. Of these the principal are, in the eleventh and twelfth centuries, Ordericus Vitalis, Eadmer, Florence of Worcester, William of Malmesbury, Henry of Huntingdon, William of Newbridge, Simeon of Durham, and Roger de Hove-

den; in the thirteenth and fourteenth, Matthew Paris, Walter Hemingford, Nicholas Trivet, Ralph Higden, and Henry Knighton; in the fifteenth, Thomas Walsingham, John de Whethamstede, Thomas de Elmham, William Botoner (otherwise calling himself William of Wyrcester), and John Rouse.

9. The Lowland Scotch. Literary composition in this dialect of the Saxon, which is still the popular speech throughout the greater part of Scotland, appears to have commenced at least as early as the latter part of the thirteenth century. The oldest fragment of Scottish poetry now known to exist consists of a few lines of lamentation on the death of Alexander III., which took place in 1286. [ALEXANDER III.] To the next century belongs an extended poetical work of much merit, the 'Bruce' of John Barbour, archdeacon of Aberdeen. Barbour, it is to be observed, has no other name for the language in which he writes but 'Inglis,' or English; nor does it greatly differ from that of his English contemporary Chaucer. The 'Bruce' was followed, in the same or early in the next century, by the 'Cronykil' of Andrew Wynton, prior of Lochleven, which however is a production of more historical than poetic value. The 'King's Quhair' of James I., written in the early part of the fifteenth century, is the highest flight that our poetry took for nearly 150 years after the death of Chaucer. To the close of the fifteenth century most probably belongs the 'Sir William Wallace' of Harry the Minstrel, or Blind Harry, as he is traditionally called. The next century is adorned by the names of Gawen Douglas, the translator of the 'Æneid,' and likewise the author of several original poems; of the admirable Dunbar, the Chaucer of Scotland, of Sir David Lyndesay, of James V., not to mention many others of less note, such as Walter Kennedy, Quintyn Schaw, Robert Henderson, Holland, Montgomery, &c. Of some of these however little more than the names remain. After the death of Lyndesay the spirit of Scottish song slept, or made itself audible only in a few occasional short poems by writers whose very names for the most part have perished, until it was re-awakened in the beginning of the last century by Allan Ramsay. Ramsay was followed by Ferguson, who scarcely deserved to be even his successor, and Ferguson by Burns, the last, and, in some respects, the greatest poet of his country. In prose the Scottish dialect has received comparatively little literary cultivation; but examples of its employment in compositions of considerable length are afforded by the histories of Lyndsay of Pitscottie and John Knox, and by one or two pieces from the pen of the great Buchanan. The principal Latin works of Scottish writers which it is necessary to mention here are the histories of Fordun, Major, Boece, and Buchanan, the last distinguished as the prince of the Latin poets of his age, and one of the greatest masters of Roman eloquence in modern times. To these may be added the 'Historia Ecclesiastica Scotorum' of the learned Thomas Dempster, who in this performance however is thought to display more learning than either judgment or veracity.

GREAVES. [ARMOUR.]

GREAVES, JOHN, an eminent English mathematician, scholar, and antiquary, was born at Colmore, near Alresford, Hants, in 1602; went to Balliol College, Oxford, in 1617; was elected fellow of Merton in 1624, and appointed geometry professor of Gresham College, London, in 1630. In 1637 he undertook a journey to the Levant and Egypt, with the view of examining such antiquities as might serve to illustrate antient authors, and of making astronomical and geographical observations. He spent about a year at Constantinople, and in the summer of 1638 proceeded to Egypt, where his chief performance was a survey of the pyramids, of which no satisfactory account was then extant; this was published under the title 'Pyramidographia,' in 1646. On his return he spent some months in visiting the chief cities of Italy, studying their antiquities, and consulting their libraries; and reached England early in 1640. He took up his abode at Oxford, and having been appointed Savilian professor of astronomy in November, 1643, was immediately after very properly deprived of his Gresham professorship for neglect of duty. Being of the Royalist party he was ejected from both fellowship and professorship in 1648; a matter of the less moment, inasmuch as he had a competent patrimony. He died October 8, 1652.

Mr. Greaves paid much attention to weights and measures, and published in 1647 a 'Discourse on the Roman Foot and Denarius, from whence, as from two Principles, the Measures and Weights used by the Antients may be deduced.' The bulk of his works relates to Oriental geography and astronomy. He wrote a Persian grammar, and made some progress in a Persian lexicon. In 1645 he proposed a scheme for gradually introducing the Gregorian alteration in the calendar, commonly called New Style, by omitting every 29th of February for forty years. A collection of his minor pieces was published by Dr. Birch in 1737, 2 vols. 8vo. (Ward's *Lives*.)

GREBES (*Podiceps*), a natural group of water-birds, very expert at diving. [DIVER, vol. ix., p. 36.] Mr. Swainson, in the 1st vol. of his 'Classification of Birds,' considers the *Colymbidæ* [DIVER, vol. ix., p. 37] to be composed of the Guillemots, Divers, and Grebes: he remarks that they are, with the exception of the last, all marine birds, with a lengthened, strong, straight bill; the wings generally remarkably short; and the feet placed so far back out of the equilibrium of the body, that they will not allow the birds to walk well upon the land. They are, he adds, few in number, and chiefly confined to the northern regions, though some species of Grebe are found both in South America and New Holland: the tails of all are remarkably short. 'The genera yet determined,' continues Mr. Swainson, 'are only four. The first (*Colymbus*) comprehends the true divers, of which all the three species hitherto discovered are found on the shores of Britain, although much more common on the Arctic circle. The second (*Uria*) includes the guillemots, distinguished from the last by the absence of the hinder toe [GUILLEMOT]; and these again are confined to the Northern Ocean. The third and fourth are *Podiceps* and *Podia* (Podoa?), both of which agree in having the membrane between the toes divided into lobes, similar to those on the feet of the coot; but, in the first, the hinder-toe is lobated, while in the latter it is simple. The Grebes are the most imperfect flyers, since the divers have their wings not much shorter than several of the ducks.'

In the 'Synopsis' (part iv., same vol.) Mr. Swainson thus characterizes the 'Family *Colymbidæ*. *Grebes*:'—'Bill more or less conic. Feet with toes partly webbed and partly pinnated. Tarsus compressed;' and he makes the family consist of the following genera:—*Podiceps*, Latham; *Dasyptilus*, Swainson; *Podoa*, Illiger; and *Colymbus*, Linnæus. The family is placed by the same author between the subfamily *Merganidæ* (Merganinæ?) and the family *Alcadæ*, or *Auks*.

GREECE. It is intended in the present article to present merely an outline of the history, language, and literature of Antient Greece, which the reader must fill up by aid of the articles in other parts of this work, and more particularly by the help of such works of reference as are enumerated at the end of this article. Greece was divided into a number of independent states, the history and description of which are given in separate articles, as ATTICA, ARCADIA, ACHÆA, BŒOTIA, &c.

Antient Greece lay between the 30th and 40th degrees of N. lat., and was bounded on the north by Illyria and Macedonia, from which countries it was separated by an extensive range of mountains, which extend from Mount Olympus, in the north-eastern corner of Thessaly, to the Acroceraunian Mountains, in the north-western corner of Epirus. This country was called Greece by the Romans, whence the name has descended to us. The Græci however were only one of the antient tribes of Epirus (Aristot., *Meteor.*, i. 14), and never became of any historical importance, though their name must at some period have been extensively spread on the western coast, since the inhabitants of Italy appear to have known the country at first under this name. In the Greek authors the country comprehended within the above limits is called Hellas, though it must be remarked that Hellas had a more extensive signification than we attach to the word, and was used in general to denote the country of the Hellenes wherever they might happen to be settled; thus the Grecian colonies of Cyrene in Africa, of Miletus in Asia, and of Syracuse in Sicily, formed as essential parts of Hellas as Attica, Arcadia, or Bœotia. Thus Herodotus tells us (ii., 182) that Amasis, king of Egypt, sent many presents to Hellas; and the places enumerated are Cyrene, Lindus in Rhodes, and the island Samus. Compare also Herodotus, iii., 136, where Tarentum, in Italy, is described as part of Hellas; and vii. 157, where Gelon is said to possess no small part of Hellas, since he was master of Syracuse.

Greece is usually divided by geographers into two parts, which are united by the isthmus of Corinth. The northern part contained THESSALY; EPIRUS; ACARNANIA; ÆTOLIA; LOCRIS, divided into Opuntian and Epicnemidian Locris, and Ozolian Locris; Doris [DORIANS]; PHOCIS; BŒOTIA; MEGARIS; and ATTICA. The southern part, called Peloponnesus, contained LACONIA; MESSENIA; ARCADIA; ELIS; Argolis [ARGOS]; ACHÆA; SICYONIA; and CORINTH. In addition to these states, we must reckon the numerous islands on the eastern and western coasts, which were all inhabited by the Greek race.

The relation of the peninsula of Greece to the rest of Europe, in a physical point of view, is briefly indicated in the article EUROPE.

Greece, in the flourishing periods of its history, was in all probability densely populated. According to a calculation of Mr. Clinton (*Fasti Hellenici*, vol. ii., p. 386), in which he includes the population of the islands of Eubœa, Corcyra, Leucadia, Ithaca, Cephallenia, Zacynthus, Cythera, Ægina, and Salamis, it contained a population of more than 3,500,000 inhabitants from the time of the Persian wars to the death of Alexander the Great. Greece, including the islands already named, contains about 22,231 square miles; consequently there were rather more than 157 persons to the square mile, a rate of population very little inferior to that of Great Britain in 1821, which contained 165 persons to the square mile. But it must be remarked, that though we may admit the result of all the combined evidence to prove that Greece was well peopled during the period to which Mr. Clinton's estimates refer, we by no means admit that his calculation of positive numbers rests on a basis which, for any country or age, can give trustworthy results.

History. First Period:—From the earliest times to the Trojan war.—The people whom we call Greeks (the Hellenes) were not the earliest inhabitants of the country. Among the names of the many tribes which are said to have occupied the land previous to the Hellenes, the most celebrated is that of the PELASGI, who appear to have been settled in most parts of Greece, and from whom a considerable part of the Greek population was probably descended. The Caucones, Leleges, and other barbarous tribes, who also inhabited Greece, are all regarded by a modern writer (Thirlwall's *History of Greece*, vol. i., c. 2, p. 32-61), as parts of the Pelasgic nation. He remarks 'that the name Pelasgians was a general one, like that of Saxons, Franks, or Alemanni, and that each of the Pelasgian tribes had also one peculiar to itself.' All these tribes however were obliged to submit to the power of the Hellenes, who eventually spread over the greater part of Greece. Their original seat was, according to Aristotle (*Meteor.*, i., 14), near Dodona, in Epirus, but they first appeared in the south of Thessaly about B.C. 1384, according to the common chronology. In accordance with the common method of the Greeks, of inventing names to account for the origin of nations, the Hellenes are represented as descended from Hellen, who had three sons, Dorus, Xuthus, and Æolus. Achæus and Ion are represented as the sons of Xuthus; and from these four, Dorus, Æolus, Achæus, and Ion, the DORIANS, ÆOLIANS, ACHÆANS, and IONIANS were descended, who formed the four tribes into which the Hellenic nation was for many centuries divided, and who were distinguished from each other by many peculiarities in language and institutions. At the same time that the Hellenic race was spreading itself over the whole land, numerous colonies from the East are said to have settled in Greece, and to their influence many writers have attributed the civilization of the inhabitants. Thus we read of Egyptian colonies in Argos and Attica, of a Phœnician colony at Thebes in Bœotia, and of a Mysian colony led by Pelops, from whom the southern part of Greece derived its name of Peloponnesus. The very existence of these colonies has been doubted by some writers; and though the evidence of each one individually is perhaps not sufficient to satisfy the critical inquirer, yet the uniform tradition of the Greeks authorises us in the belief that Greece did in early times receive colonies from the East—a supposition which is not in itself improbable, considering the proximity of the Asiatic coast. The time which elapsed from the appearance of the Hellenes in Thessaly to the siege of Troy is usually known by the name of the *Heroic age*. Whatever opinion we may form of the Homeric poems, it can hardly be doubted that they present a correct picture of the manners and customs of the age in which the poet lived, which, in all probability, differed little from the manners and customs of the Heroic age. The state of society described by Homer very much resembles that which existed in Europe in the Feudal ages. No great power had yet arisen in Greece; it was divided into a number of small states, governed by hereditary chiefs, whose power was limited by a martial aristocracy. Piracy was an honourable occupation, and war the delight of noble souls. Thucydides informs us (i., 4) that the commencement of Grecian civilization is to be dated from the reign of Minos of Crete, who acquired a naval power and cleared the Ægean Sea of pirates. Among the most celebrated heroes of this period were Bellerophon and Perseus, whose adventures were laid in the East; Theseus, the king of Athens; and Hercules. Tradition also preserved the account of expeditions undertaken by several chiefs united together, such as that of the Argonauts, of the Seven against Thebes, and of the siege of Troy, B.C. 1184.

Second Period:—From the Siege of Troy to the commencement of the Persian Wars, B.C. 500.—We learn from Thucydides (i., 12) that the population of Greece was in a very unsettled state for some time after the Trojan war. Of the various migrations which appear to have taken place, the most important in their consequences were those of the Bœotians from Thessaly into the country afterwards called Bœotia, and of the Dorians into Peloponnesus, the former in the sixtieth and the latter in the eightieth year after the Trojan war. About the same period the western coast of Asia Minor was colonized by the Greeks. The antient inhabitants of Bœotia, who had been driven out of their homes by the invasion of the Bœotians, together with some Æolians, whence it has acquired the name of the Æolian migration, left Bœotia, B.C. 1124, and settled in Lesbos and the north-western corner of Asia Minor. They were followed by the Ionians in B. C. 1040, who, having been driven by the Achæans from their abode on the Corinthian Gulf, had taken refuge in Attica, whence they emigrated to Asia Minor and settled on the Lydian coast. The south-western part of the coast of Asia Minor was also colonized about the same period by Dorians. The number of Greek colonies, considering the extent of the mother-country, was very great; and the readiness with which the Greeks left their homes to settle in foreign parts forms a characteristic feature in their national character. In the seventh century before Christ the Greek colonies took another direction: Cyrene, in Africa, was founded by the inhabitants of Thera; and the coasts of Sicily and the southern part of Italy became studded with so many Greek cities, that it acquired the surname of the Great, or Greater, Greece.

The two states of Greece which attained the greatest historical celebrity were Sparta and Athens. The power of Athens was of later growth; but Sparta had from the time of the Dorian conquest taken the lead among the Peloponnesian states, a position which she maintained by the conquest of the fertile country of Messenia, B.C. 688. Her superiority was probably owing to the nature of her political institutions, which are said to have been fixed on a firm basis by her celebrated lawgiver LYCURGUS, B.C. 884. At the head of the polity were two hereditary chiefs, but their power was greatly limited by a jealous aristocracy. Her territories were also increased by the conquest of Tegea in Arcadia. Athens only rose to importance in the century preceding the Persian wars; but even in this period her power was not more than a match for the little states of Megaris and Ægina. The city was long harassed by intestine commotions, till the time of Solon, B.C. 594, who was chosen by his citizens to frame a new constitution and a new code of laws, to which much of the future greatness of Athens must be ascribed.

We have already seen that the kingly form of government was prevalent in the Heroic age. But during the period that elapsed between the Trojan war and the Persian invasion hereditary political power was abolished in almost all the Greek states, with the exception of Sparta, and a republican form of government established in its stead. In studying the history of the Greeks we must bear in mind that almost every city formed an independent state, and that, with the exception of Athens and Sparta, which exacted obedience from the other towns of Attica and Laconia respectively, there was hardly any state which possessed more than a few miles of territory. Frequent wars

between each other were the almost unavoidable consequence of the existence of so many small states nearly equal in power. The evils which arose from this state of things were partly remedied by the influence of the Amphictyonic council [AMPHICTYONS], and by the religious games and festivals which were held at stated periods in different parts of Greece, and during the celebration of which no wars were carried on.

In the sixth century before the Christian æra Greece rapidly advanced in knowledge and civilization. Literature and the fine arts were already cultivated in Athens under the auspices of Pisistratus and his sons; and the products of remote countries were introduced into Greece by the merchants of Corinth and Ægina.

Third Period:—From the commencement of the Persian wars to the death of Philip of Macedon, B.C. 336.—This was the most splendid period of Grecian history. The assistance which the Athenians gave to the Asiatic Greeks in their resistance to the Persians, and the part which they took in the burning of Sardis, B.C. 499, drew upon them the vengeance of Darius. After the reduction of the Asiatic Greeks, a Persian army was sent into Attica, but was entirely defeated at Marathon, B.C. 490, by the Athenians under Miltiades. Ten years afterwards the whole power of the Persian empire was directed against Greece; an immense army, led in person by Xerxes, advanced as far as Attica, and received the submission of almost all the Grecian states, with the exception of Athens and Sparta. But this expedition also failed; the Persian fleet was destroyed by the battles of Artemisium and Salamis; and the land forces were entirely defeated in the following year, B.C. 479, at Platæa in Bœotia. [XERXES; SALAMIS; THEMISTOCLES; PAUSANIAS; &c.] Sparta had, previous to the Persian invasion, been regarded by the other Greeks as the first power in Greece, and accordingly she obtained the supreme command of the army and fleet in the Persian war. But during the course of this war the Athenians had made greater sacrifices, and had shown a greater degree of patriotism and courage. After the battle of Platæa a confederacy was formed by the Grecian states for the purpose of carrying on the war against the Persians. Sparta was at first placed at the head of it; but the allies, disgusted with the tyranny of Pausanias, the Spartan commander, gave the supremacy to Athens. The allies, who consisted of the inhabitants of the islands and coasts of the Ægean Sea, were to furnish contributions in money and ships, and the delicate task of assessing the amount which each state was to pay was assigned to Aristides. The yearly contribution was settled at 460 talents, about 115,000*l*., and Delos was chosen as the common treasury. The Athenians, under the command of Cimon, carried on the war vigorously, defeated the Persian fleets, and plundered the maritime provinces of the Persian empire. During this period the power of Athens rapidly increased; she possessed a succession of distinguished statesmen, Themistocles, Aristides, Cimon, and Pericles, who all contributed to the advancement of her power, though differing in their political views. Her maritime greatness was founded by Themistocles, her revenues were increased by Pericles, and her general prosperity, in connexion with other causes, tended to produce a greater degree of refinement than existed in any other part of Greece. Literature was cultivated, and the arts of architecture and sculpture, which were employed to ornament the city, were carried to a degree of excellence that has never since been surpassed. While Athens was advancing in power, Sparta had to maintain a war against the Messenians, who again revolted, and were joined by a great number of the Spartan slaves (B.C. 464-455). But though Sparta made no efforts during this period to restrain the Athenian power, it was not because she wanted the will, but the means. These however were soon furnished by the Athenians themselves, who began to treat the allied states with great tyranny, and to regard them as subjects, and not as independent states in alliance. The tribute was raised from 460 to 600 talents, the treasury was removed from Delos to Athens, and the decision of all important suits was referred to the Athenian courts. When any state withdrew from the alliance, its citizens were considered by the Athenians as rebels, and immediately reduced to subjection. The dependent states, anxious to throw off the Athenian dominion, entreated the assistance of Sparta, and thus, in conjunction with other causes, arose the war between Sparta and Athens, which lasted for twenty-seven years (B.C. 431-404), and is usually known by the name of the Peloponnesian War. It terminated by again placing Sparta at the head of the Grecian states. Soon after the conclusion of this war Sparta engaged in a contest with the Persian empire, which lasted from B.C. 400 to 394. The splendid successes which Agesilaus, the Spartan king, obtained over the Persian troops in Asia Minor, and the manifest weakness of the Persian empire, which had been already shown by the retreat of the ten thousand Greeks from the heart of the Persian empire [ANABASIS; XENOPHON], appeared to have induced Agesilaus to entertain the design of overthrowing the Persian monarchy; but he was obliged to return to his native country to defend it against a powerful confederacy which had been formed by the Corinthians, Thebans, Argives, Athenians, and Thessalians, for the purpose of throwing off the Spartan dominion. The confederates were not however successful in their attempt; and the Spartan supremacy was again secured for a brief period by a general peace made B.C. 387, usually known by the name of the Peace of Antalcidas. Ten years afterwards the rupture between Thebes and Sparta began, which led to a general war in Greece, and for a short time placed Thebes at the head of the Grecian states. The greatness of Thebes was principally owing to the wisdom and valour of two of her citizens, PELOPIDAS and EPAMINONDAS. After the death of Epaminondas at the battle of Mantinea, B.C. 362, Thebes again sunk to its former obscurity. The Spartan supremacy was however destroyed by this war, and her power still more humbled by the restoration of Messenia to independence, B.C. 369. From the conclusion of this war to the reign of Philip of Macedon Greece remained without any ruling power. It is only necessary here to mention the part which Philip took in the Sacred War, which lasted ten years (B.C. 356-346), in which he appeared as the defender of the Amphictyonic council, and which terminated by the conquest of the Phocians. The Athenians, urged on by Demosthenes, made an alliance with the Thebans for the purpose of resisting Philip; but their defeat at Chæronea, B.C. 388, secured for the Macedonian king the supremacy of Greece. In the same year a congress of Grecian states was held at Corinth, in which Philip was chosen generalissimo of the Greeks in a projected war against the Persian empire; but his assassination in B.C. 336 caused this enterprise to devolve upon his son Alexander.

Fourth Period:—From the accession of Alexander the Great to the Roman Conquest, B.C. 146.—The conquests of Alexander extended Greek influence over the greater part of Asia west of the Indus. After his death the dominion of the East was contested by his generals, and two powerful empires were permanently established; that of the Ptolemies in Egypt, and the Seleucidæ in Syria. The dominions of the early Syrian kings embraced the greater part of Western Asia; but their empire was soon divided into various independent kingdoms, such as that of Bactria, Pergamus, &c., in all of which the Greek language was spoken, not merely at court, but to a considerable extent in the towns. From the death of Alexander to the Roman conquest Macedon remained the ruling power in Greece. The Ætolian and Achæan leagues were formed, the former B.C. 824, the latter B.C. 281, for the purpose of resisting the Macedonian kings. Macedonia was conquered by the Romans, B.C. 197, and the Greek states declared independent. This however was merely nominal: they only exchanged the rule of the Macedonian kings for that of the Roman people; and in B.C. 146 Greece was reduced to the form of a Roman province, called Achæa, though certain cities, such as Athens, Delphi, &c., were allowed to have the rank of free towns. The history of Greece from this period forms part of that of the Roman empire. It was overrun by the Goths in A.D. 267, and again in A.D. 398, under Alaric; and after being occupied by the Crusaders and Venetians, at last fell into the power of the Turks on the conquest of Constantinople.

Language and Literature.—The Greek language forms a branch of that extensive family of languages which are known by the name of Indo-Germanic. The languages included under this name are—the Sanscrit and its derivative dialects; the Zend, and the other antient dialects of Persia; the Teutonic languages, comprising the Gothic, the German, the Anglo-Saxon, the Icelandic, the Swedish, &c.; the Latin and Greek; the Slavonic languages, including the Lithuanian, Russian, Polish, Bohe-

mian, &c.; and lastly, the Celtic languages, which appear to belong to the same family, though they differ in some respects from the general character of the other cognate tongues. The affinity which subsists between all these languages is evident, not merely from the number of words which are common to them all, but also from the similarity of their grammatical forms. The same words are used in most of these languages for the pronouns, the numerals, and the most simple of the prepositions. They are distinguished from those of the Semitic family (to which the Hebrew, Syriac, Arabic, Ethiopic, and other kindred tongues belong), by a different mode of inflection, by different words for the numerals, pronouns, and prepositions, and by the power of forming compound words, which are not found, with the exception of a few instances, in the Semitic tongues.

The Greek has existed as a spoken language for at least 3000 years, and has been more widely diffused than any other tongue, unless we except the Arabic and English. It had attained a great degree of perfection in the ninth century before the Christian æra; and it was eventually spoken not only in Greece and the numerous Grecian colonies, but was extended over a large part of Western Asia by the conquests of Alexander. The population of Western Asia has always been of a very mixed kind, and in the thinly-inhabited districts the native languages, whatever they might be, were doubtless preserved, especially in such mountainous countries as Armenia and Kurdistan; but the great number of towns with Greek names, and the scattered notices which we find in the Greek writers, sufficiently prove that, under the successors of Alexander, the towns of Asia Minor and of Syria contained a large population who were familiar with the Greek tongue. It is also evident from the books of the New Testament, that the lower orders in Palestine could converse in Greek as well as in their native Syriac; and many of the books of the New Testament were written in Greek by men who had received very little education. In Egypt also, under the Ptolemies, Greek became the language of a large proportion of the townspeople, and was used, jointly with the native language, in the business of administration. The conquest of Greece by the Romans tended still further to the diffusion of the Greek language. The embassy sent by the Athenians to Rome (B.C. 155), consisting of three of the most eminent philosophers of the age, tended to introduce a knowledge of the Greek language and literature among the Romans; and though the study was condemned by Cato and many others of the old school, 'it soon became a fashion for well-educated Romans to read, to speak, to translate, and even to write in this foreign language.' Under the dominion of the Cæsars the language and literature of Greece were more extensively cultivated than at any other period. Greek was not only taught at Athens and Rome, but in every part of the Roman empire Greek philosophers and rhetoricians were maintained by their numerous pupils. The university of Marseilles is praised by Tacitus (*Agric.*, iv.) as a place distinguished for its Grecian refinement and provincial simplicity of manners. Augustus Cæsar was educated at the university of Apollonia; and that of Tarsus is said by Strabo (b. xiv., p. 463, Casaubon) to have rivalled those of Athens and Alexandria. After the fall of the Western Empire and the extinction of learning in the West, the Greek literature and philosophy were still cultivated in Asia and at Constantinople, where Greek continued the spoken language of the people till the city was taken by the Turks in the fifteenth century. This is usually considered as the time at which it ceased to be a living language; but the best specimens of modern Greek, as it is called, can be read without much difficulty by any person acquainted with the Greek of Xenophon and Demosthenes; and the resemblance between the antient and modern language is sufficient to justify us in considering the Greek language as one which has not ceased to be spoken from the time of Homer to the present day.

The Greek language is usually divided into four dialects, the Æolic, Ionic, Doric, and Attic, the peculiarities of which are noticed in separate articles. The Bœotian, Thessalian, Laconian, and Sicilian dialects are only subdivisions. The four dialects may however be reduced to two, the Æolic or Doric, and the Ionic or Attic: the latter originally spoken in the northern part of Peloponnesus and Attica, the former in the other parts of Greece. Till the time of Alexander the Greeks generally wrote in that dialect in which they had been brought up, and thus we have works in the Æolic, Ionic, Doric, and Attic dialects. But the number and superiority of the Attic writers gradually caused this dialect to be adopted by Greeks who were not natives of Attica; and thus the Attic dialect, somewhat modified by the peculiarities of other dialects, was called the *common* or *Hellenic dialect* (ἡ κοινή, or ἡ Ἑλληνική διάλεκτος); in which almost all Greek prose writers from the time of Aristotle composed their works. Writers in this *common dialect* are, Aristotle, Theophrastus, Polybius, Diodorus, Strabo, Plutarch, Dionysius of Halicarnassus, Lucian, Ælian, Dion Cassius, Appian, and many others; though some of these writers, such as Lucian, Arrian, in his 'Anabasis,' Ælian, &c., endeavoured to write in the pure Attic dialect, and to avoid every phrase which was not sanctioned by some Attic writer such as Xenophon or Thucydides. Poetry however was not written in this common dialect; the peculiarities of the Homeric dialect were imitated by all succeeding poets; and the poets of the Alexandrian school, such as Apollonius and Callimachus, and at a later period Nicander, Oppian and others, continued to write in the Homeric dialect, or in what they considered such, which could only be intelligible to those who had received a learned education. In the countries where the Macedonians established themselves the Attic dialect received many modifications; and as Alexandria in Egypt was, under the Ptolemies, the principal place where this dialect was cultivated, it was called the Alexandrine or Macedonian dialect. The Septuagint version of the Old Testament was written in this dialect; but it can hardly be considered as a fair specimen of the language spoken at Alexandria, since the Jewish translators have introduced into the version many Hebrew phrases and constructions. The New Testament was written in the same dialect, whence it has passed with some variations into the writings of the fathers, and has been called Ecclesiastical Greek. The Greek spoken at Constantinople became more corrupted, and so many foreign words were introduced into the language, that a glossary is necessary for understanding the writers of the Eastern empire.

The study of the Greek language, after being almost entirely neglected in the west of Europe for nearly a thousand years, was revived in the fifteenth century by the Greeks, who were spread over Europe after the taking of Constantinople by the Turks. Some attention had been paid to it in Italy in the preceding century; the Republic of Florence engaged (A.D. 1360) Leo or Leontius Pilatus as professor of the Greek language. He was succeeded, after a lapse of some years, by Manuel Chrysoloras (about A.D. 1400); and its study was encouraged at Rome by Cardinal Bessarion, who was a Greek. It is however an error to suppose that Greek was unknown in western Europe and in this island until the so-called revival of literature, though it is true that about the time above mentioned the study of it began to be prosecuted with greater activity, and became so popular that John Reuchlin informs us that he explained a play of Aristophanes to more than 300 auditors in the university of Ingolstadt. Of late years the study of the language and the literature of the Greeks has been pursued, especially among the Germans, with great success.

The history of Greek literature may be divided into three periods: the first extending from the earliest times to the rise of Athenian literature; the second comprising the flourishing period of Athenian literature; and the third comprehending all the writers from the time of Alexander to the taking of Constantinople by the Turks. An outline of Athenian literature has already been given [Athens, vol. iii., p. 17); and some account of the 3rd period is given above: we shall therefore conclude the article with a few observations on its rise.

The Greek colonies of Asia Minor appear to have attained a considerable degree of civilization soon after their foundation, a circumstance probably owing to their intercourse with the Lydians and other Asiatic nations, and to their exemption from the political revolutions to which the mother-country was exposed. It was in the Ionian and Æolian cities on the coast of Asia Minor that the literature of Greece originated; and to the Greeks transplanted into Asia we are indebted for the earliest specimens we possess of Greek poetry and historical composition. Whether we look upon the 'Iliad' and 'Odyssey' as the work of one individual or of many bards, it must be regarded as the composition of Asiatic Greeks, and is a proof of the perfection which the language had attained in the ninth or

tenth century before our æra. Of the poets previous to Homer nothing satisfactory is known. Olen is mentioned by Pausanias (ix., 27, 2) as the most antient; he was followed by Linus, Orpheus, Musæus, and many others. There were many poems circulated in the later ages of Greek literature under the names of Linus, Orpheus, and Musæus, some of which have come down to us, but they cannot be regarded as the genuine works of these antient poets. Their poems appear to have been upon religious subjects, and were entitled 'Hymns' (ὕμνοι). The 'Iliad' and 'Odyssey' formed a part of a series of poems, which are usually known by the name of the 'Epic Cycle.' The poems known under this name were arranged according to the order of events by the grammarians of Alexandria, and included the works of many bards, of whom the most celebrated besides Homer were HESIOD, Arctinus (B.C. 775), Cinæthon (B.C. 765), Stasinus, Prodicus, Augias, and Lesches (B.C. 657). The Cyclic poems commenced with an account of the origin of the gods and of the world, and were continued through the Heroic times, describing the Argonautic expedition, the adventures of Hercules and Theseus, the principal events of the Theban and Trojan wars, and the fortunes of the Greeks after the fall of Troy. Lyric poetry arose on the decline of the epos, and was much cultivated from about B.C. 776 to the commencement of the Persian wars. The lyric poems of this period were considered, even in the most flourishing periods of Athenian poetry, as one of the most valuable parts of Greek literature. Unfortunately we have nothing remaining of them but a few fragments, which are hardly sufficient to enable us to form an opinion upon the subject. Many of the lyric poems bordered upon the epic, and contained the subjects of heroic song. They were sung, accompanied by music, by bands of youths and maidens; and, in course of time, a performer was introduced during pauses in the song to narrate the history or personate the character of some celebrated hero; to which the origin of Greek tragedy may be ascribed. But the lyric poetry of the Greeks was written for all occasions it was employed by Archilochus, Alcæus, and Hipponax, for the purpose of satire and personal invective; by Tyrtæus, Terpander, and Alcman, to rouse the martial spirit of the Spartans; and by Anacreon, Ibycus, and Mimnermus, to exalt the pleasures of the senses. The following is a list of the principal lyric poets, with the time when they lived:—Callinus, who is said to have invented the elegy, B.C. 736-712; Archilochus, said to have invented the Iambic verse, B.C. 708-665; Simonides, B.C. 693-662; Tyrtæus, B.C. 683; Terpander, B.C. 676-644; Alcman, B.C. 671-631; Arion, the inventor of the dithyrambus, B.C. 628-571; Mimnermus, B.C. 630-586; Sappho, B.C. 611-592; Alcæus, B.C. 611; Stesichorus, B.C. 608; Solon, B.C. 594; Ibycus, B.C. 560; Anacreon, B.C. 559-525; Hipponax, B.C. 546; Simonides, B.C. 520; Pindar, born B.C. 518. Many didactic poems, fables, proverbs, &c., were written in the 6th century (when Æsop is said to have lived), and served to prepare the way for prose composition. The earliest historical compositions treated principally of mythological subjects, and many of them were little else than the Cyclic poems turned into prose. The earliest historical writer appears to have been Cadmus of Miletus, who lived in the beginning of the sixth century; he was succeeded by Hecatæus, B.C. 500; Hellanicus, B.C. 496-411; Pherecydes, B.C. 480; Xanthus, B.C. 463; and HERODOTUS, born B.C. 484, who well deserves the title of *Father of History*.

Physical philosophy began to be cultivated in Asia Minor in the early part of the sixth century, under Thales of Miletus. He was succeeded by Anaximander, Anaximenes, Heraclitus, and others; but the reputation of the Ionian school was soon eclipsed by the Pythagoræan and Eleatic schools in Italy. [PYTHAGORAS; ELEATIC PHILOSOPHY.] Anaxagoras introduced into Athens the philosophy of the Ionian school; but the Athenian philosophers were indebted to the Eleatic school for the first principles of dialectic, in which they became so celebrated. The school, of which Socrates was the founder, is chiefly known to us through the writings of Plato and Xenophon. From this period philosophy was extensively cultivated at Athens. The doctrines of the academy, over which Plato presided for nearly half a century, were somewhat modified by Arcesilaus (B.C. 296), who is considered as the founder of the Middle, as distinguished from the Old Academy. The New Academy was founded by Carneades, who lived about a century after Arcesilaus. [ACADEMY.] The doctrines of the Peripatetic, Stoic, and Epicurean schools, founded respectively by ARISTOTLE, ZENO, and EPICURUS, are given in separate articles. Greek philosophy was studied, as we have already remarked, by the Romans; and in Rome, Athens, Alexandria, and many other cities of the Roman empire, numerous teachers of the Platonic, Peripatetic, Stoic, and Epicurean sects were supported by salaries from the state, or by private fees from their pupils. Many of the fathers, such as Clement and Origen, paid great attention to the Platonic philosophy as it was then taught at Alexandria; but the study of Greek philosophy gradually declined in consequence of the progress of Christianity, and the schools in which it was taught were finally suppressed in the time of Justinian.

The works hereinafter enumerated will be useful to those who prosecute the study of the language and literature of Antient Greece; and the list, though far from complete, may serve as a kind of index to those who have not the opportunity of visiting large libraries or procuring catalogues. It is hardly necessary to premise that the works enumerated have very different degrees of merit, and that some are only mentioned as the best or the only works of the kind, or as the best known to the writer.

Geography.—Strabo (books viii.—x. treat of Greece, &c.); there is a good German translation of Strabo by Groskurd, 4 vols. 8vo., Berl., 1834; as to the French translation, see GOSSELIN; Ptolemæus, 'Geographia;' Pausanias, 'Description of Greece;' Kruse, 'Hellas oder geographisch-antiquarische Darstellung des Alten Griechenlandes,' 3 vols. 8vo., Leip. 1825; Cramer, 'Geographical and Historical Description of Antient Greece,' 3 vols. 8vo., Oxf. 1828; Mannert, 'Geographie der Griechen und Römer,' Leip. 1812 and 1822; Ukert, 'Handbuch der Geographie der Griechen und Römer,' 2 vols. 8vo., Leip. 1826-32; Clarke, 'Travels;' Chandler, 'Travels in Greece and Asia Minor,' Lond. 1746, 4to.; a French translation of the same with notes by Servois and Du Bocage, 3 vols. 8vo., Paris, 1806; Thiersch, 'Etat Actuel de la Grèce,' 2 vols. 8vo.; the article GEOGRAPHY in this work; Dodwell, 'Topographical and Historical Tour through Greece,' 2 vols. 4to., Lond. 1819; Gell's 'Itinerary of Greece,' 4to., Lond. 1810; Hobhouse's 'Account of a Journey into Albania,' &c., 4to., Lond. 1812; Holland's 'Travels in the Ionian Islands, Albania,' &c., 4to., Lond. 1815; Leake's 'Travels in the Morea,' 3 vols. 8vo., Lond. 1830; Leake's 'Travels in Northern Greece,' 4 vols. 8vo., Lond. 1830; Pashley's 'Travels in Crete,' 2 vols. 8vo., Camb. 1837.

History and Antiquities.—Herodotus is the earliest Greek historian whose works have come down to us. The main subject of his History is the wars between the Greeks and Persians from B. C. 500 to the capture of Sestos, B. C. 479; but he gives, by way of episode, many portions of the history of other countries and of earlier ages. The first book of Thucydides contains a summary of Grecian history from the capture of Sestos to the commencement of the Peloponnesian war, B.C. 431, preceded by a most valuable account of the early state of Greece; the remaining books give the history of the Peloponnesian war from B. C. 431—410. Xenophon's 'Hellenica,' or Grecian History, commences where that of Thucydides leaves off, and continues the narrative to the battle of Mantinea, B. C. 362. From B. C. 362 to the accession of Alexander, B. C. 336, we possess the account of no contemporary historian; we must therefore rely on the sixteenth book of Diodorus of Sicily; but much valuable information as to this period may be obtained by a careful perusal of the Attic Orators. The history of Alexander is given by Arrian (who must be regarded almost as a contemporary writer, since he compiled his narrative chiefly from the journals of some of Alexander's officers), by Quintus Curtius, Diodorus, and Plutarch. The sources of Grecian history from the death of Alexander to B. C. 224, are Diodorus, Justin, and some of Plutarch's Lives. From B. C. 224 to the Roman conquest, B. C. 146, we possess the history of Polybius. Several valuable works on the early history of Greece, principally written by Germans, have been published within the last few years. Among these we may mention, Wachsmuth, 'Hellenische Alterthumskunde, aus dem Gesichtspunkte des Staates,' 2 vols. 8vo., Halle, 1826—30; Müller, 'Geschichten Hellenischer Stämme und Städte,' 3 vols. 8vo., Bresl. 1820—1824; the first volume contains a history of Orchomenos and the Minyæ; the two last a history of the Dorians; the history of the Dorians has been translated into English by Tufnell and Lewis, 2 vols. 8vo., Oxf. 1830· Müller, Ægineticorum Liber,' 8vo.,

Berl. 1817; Tittmann, 'Darstellung der Griechischen Staatsverfassungen,' 8vo., Leip. 1822; Manso, 'Sparta, ein Versuch zur Aufklärung der Geschichte und Verfassung dieses Staates,' 3 vols. 8vo., Leip. 1800—1805; Clinton, 'Fasti Hellenici,' vol. 1, Oxf. 1834. The 'History of Greece from the earliest times to the death of Alexander' has been written by Gillies, and with still more industry by Mitford. Of the 'History of Greece' in the 'Cabinet Cyclopædia' by Mr. Thirwall, 4 volumes only have yet appeared. The 'History of Greece from the accession of Alexander to the Roman Conquest' is treated of by Dr. Gast, 4to., Lond. 1782; and the 'History of the Successors of Alexander,' by Joh. G. Droysen, Hamburg, 1836, a work which the student will find useful. Those who wish for information in a smaller compass can consult Heeren, 'Manual of Antient History,' (p. 118—313, Eng. transl.); Keightley's 'History of Greece;' and the 'History of Greece' published by the Society for the Diffusion of Useful Knowledge, which brings the history down to the Roman conquest. See also, Heeren's 'Sketch of the Political History of Antient Greece,' Oxf. 1829, Eng. transl.; Clinton's 'Fasti Hellenici,' vols. 2 and 3, Oxf. 1827—1830; Böckh, 'Die Staatshaushaltung der Athener,' 2 vols. 8vo., Berl. 1817; translated into English, 2 vols. 8vo., Lond. 1828.

It is to be regretted that we possess no good work on the history of the Greek colonies. The work of Raoul Rochette, entitled 'Histoire Critique de l'Establissement des Colonies Grecques,' 4 vols. 8vo., Paris, 1815, is described by Mr. Thirlwall ('History of Greece,' vol. ii., p. 156,) as a 'book which will be chiefly useful to his successor, as an example of almost all the faults which he ought to avoid. At least one half of it is a mass of the dullest and most unpoetical fictions, expanded into the empty form of a political history; and in the remainder we should seek in vain for any of the facts which alone render the subject interesting.' There are several works on separate colonies, as Heyne, 'Prolusiones XVI. de Civitatum Græcarum per Magnam Græciam et Siciliam Institutis et Legibus,' *Opuscula*, vol. vii.; Brükner, 'Historia Reipublicæ Massiliensium,' Gött. 1826; Thrige, 'Res Cyrenensium,' 8vo., 1828; Rambach, 'De Mileto ejusque Coloniis,' 4to., 1790.

The principal works on Grecian Antiquities, in addition to those that have already been mentioned, are, Gronovius, 'Thesaurus Antiquitatum Græcarum,' 12 vols. fol.; Petitus, 'De Legibus Atticis,' fol.; Potter, 'Archæologia Græca, or the Antiquities of Greece,' 2 vols. 8vo. (a work which we by no means recommend); Hermann, 'Lehrbuch der Griechischen Staatsalterthümer,' 8vo., 1831; Boeckh, 'Corpus Inscriptionum Græcarum,' 2 vols. fol., Berl. 1828-35.

Religion.—Bryant, 'New System or Analysis of Antient Mythology;' Sainte Croix, 'Recherches Historiques et Critiques sur les Mystères du Paganisme,' sec. éd., revue et corrigée par Silvestre de Sacy, 2 vols. 8vo., Paris, 1817; Creuzer, 'Symbolik und Mythologie der alten Völker besonders der Griechen,' fortgesetzt von F. G. Mone, 6 vols. 8vo., Darmst. 1821—4; K. O. Müller, 'Prolegomena zu einer wissenschaftlichen Mythologie, 8vo., Göttin. 1825; Buttmann, 'Mythologus oder Abhandlungen und Aufsätze über die Sagen der Griechen, Römer, und Hebräer,' 2 vols. 8vo., Berl. 1828—1829; Lobeck, 'Aglaophamus, sive de Theologiæ Mysticæ Græcorum Causis,' 2 vols. 8vo., Regiom. 1830; Keightley, 'Mythology of Antient Greece and Italy,' 8vo., Lond. 1831; Van Dalen, 'De Oraculis veterum Ethnicorum Dissertationes Sex,' Amst. 1700. Many of the works given above under History and Antiquities contain information on Greek mythology.

Philosophy.—Brucker, 'Historia Philosophiæ,' 6 vols. 4to., Leip. 1767; Cousin, 'Introduction à l'Histoire de la Philosophie,' 8vo., 1829; Tennemann, 'Geschichte der Philosophie,' 11 vols. 8vo., Leip. 1799—1829; Ritter, 'Geschichte der Philosophie,' 4 vols. 8vo., Hamb. 1829—1834; Ast, 'Grundriss einer Geschichte der Philosophie,' 8vo., Landshut, 1805.

Geometry and Astronomy,—The reader is referred to the articles ASTRONOMY and GEOMETRY in this work.

Fine Arts.—Pliny, 'Historia Naturalis;' Pausanias, 'Description of Greece.' Pausanias lived in the second century of the Christian æra; his 'Description of Greece' gives a very full account of the works of art which existed in Greece at that time. Winckelmann, 'Geschichte der Kunst des Alterthums,' 4 vols. 8vo., Dresd.; Eckhel's works on Numismatik [ECKHEL]; Rasche, 'Lexicon Rei Numariæ,' 18 vols. 8vo., Leips. 1785-1804; Thiersch, 'Ueber die Epochen der bildenden Kunst unter den Griechen,' 8vo., Münch.; the article CIVIL ARCHITECTURE in this work; K. O. Müller, 'De Phidiæ Vita et Operibus Commentationes tres,' 4to., Gött. 1827; K. O. Müller, 'Handbuch der Archäologie und Kunst,' 8vo., Bresl. 1830; Spon, 'L'Etat present d'Athens,' Lyon, 1674; Stuart's 'Antiquities of Athens,' 4 vols. fol., Lond.; Hamilton, 'Antiquités Etrusques, Grecques, et Romaines,' 4 vols. fol., 1765—1775; Flaxman, 'Lectures on Sculpture,' 8vo., Lond.; Quatremère de Quincy, 'Le Jupiter Olympien, ou l'Art de la Sculpture Antique, considéré sous un nouveau point de vue,' fol., Paris, 1815; Quatremère de Quincy, 'Monuments et Ouvrages d'Art Antiques restitués, d'apres les Descriptions des Ecrivains Grecs et Latins,' 2 vols. 4to., Paris, 1829; Leake, 'Researches in Greece,' 4to., Lond.; Leake, 'Topography of Athens,' 4to., Lond.; Visconti, 'Memoir on the Sculpture of the Parthenon;' Wilkins, 'Atheniensia,' 8vo., Lond.; Bröndsted, 'Voyages et Recherches en Grèce;' 'Specimens of Antient Sculpture, selected from different Collections in Great Britain, by the Society of Dilettanti,' 2 vols. fol., 1809-35; 'Unedited Antiquities of Attica, by the Society of Dilettanti,' 4to., Lond. 1832; and the French translation of the same work, with notes by Hittorf, fol., Paris, 1832; 'Elgin and Phigaleian Marbles,' 2 vols. 12mo., Lond., forming part of the 'Library of Entertaining Knowledge.'

Language.—The following list is only intended to direct the attention of the student to a few of the most useful books on the Greek language. Budæus, 'Commentarii Linguæ Græcæ,' fol.; Viger, 'De Græcæ Dictionis Præcipuis Idiotismis,' edited by Hermann; G. Hermann, 'De Emendanda Ratione Græcæ Grammaticæ,' 8vo., Leip. 1801; G. Hermann, 'Elementa Doctrinæ Metricæ,' 8vo., Leip. 1816; Matthiä, 'Griechische Grammatik,' 3 vols. 8vo., Leip. 1836: this work has been translated into English in 2 vols. 8vo., by Blomfield, and several times edited by Kenrick: see a notice of the same work in the 'Journal of Education,' No. 10, in which the writer remarks 'that the first volume, which treats of etymology, though it is a most useful collection of facts, is far behind the philological knowledge of the present day. It is not deficient in the *facts* of grammar, for these are accumulated almost to profusion; but the matter is often ill-arranged, and the remarks of the author, instead of leading the pupil to more correct views of language, are in many instances more likely to bewilder him, and to inculcate erroneous principles. The second volume (with the end of the first), which is on the syntax, is a very different performance from the etymological part, and we believe will stand the test of a strict examination. There are indeed few scholars to whom it will not be useful for reference.' Bernhardy, 'Wissenschaftliche Syntax der Griechischen Sprache,' 8vo., Berlin, 1829, a valuable work. Buttmann has published three grammars: one entitled 'Schulgrammatik,' of which there is a very bad translation in English; another, 'Griechische Grammatik,' of which there are two English translations, one published in London, and the other, which is the better translation, in the United States; and a third, 'Ausführliche Griech. Sprachlehre,' 2 vols. 8vo., Berl. 1819—27, which is not translated; see a short notice of the 'Griechische Grammatik' in the 'Journal of Education,' No. 13, in which the writer observes 'that the "Ausführliche Grammatik" is an admirable work for the more advanced Greek scholar, and should take precedence of all yet existing.' Buttmann's 'Lexilogus oder Beyträge zur Griechischen Wörtererklärung, hauptsächlich für Homer und Hesiod,' 2 vols. 12mo., Berl. 1825, translated by Fishlake; Thiersch, 'Griech. Grammatik, vorzüglich des Homerischen Dialects,' 8vo., Leip. 1828; the first part, containing the etymology, is translated into English by the late Professor Sandford; Kühner, 'Ausführliche Grammatik der Griech. Sprache,' 2 vols. 8vo., Hann. 1834; this is a very excellent work; the author has explained many forms of the Greek language by a careful investigation of the other languages of the Indo-Germanic family. The student will obtain much valuable information from Bopp's 'Vergleichende Grammatik des Sanskrit, Zend, Griechischen, Lateinischen, Litthauischen, Gothischen, und Deutschen,' of which the first part was published at Berlin, 1833; with a notice of the same work in the 'Journal of Education,' No. 16, by the late Dr. Rosen; Pott's 'Etymologische Forschungen auf dem Gebiete der Indo-Germanischen Sprachen,' 2 vols. 8vo., Lemgo, 1833—36,

with two notices of the same work in the 'Journal of Education,' Nos. 18 and 20, by the late Dr. Rosen.

Many of the etymological forms of the Greek language are explained in the review of Matthiä's Grammar in the 'Journal of Education,' mentioned above; in an article on the 'Etymological forms of the Greek language,' in the 'Journal of Education,' No. 9; and in the Appendix to an Introductory Lecture delivered at the University of London, by Professor Long, on 'the Study of the Greek and Latin languages.'

Works on the language of the Greek Testament:—Planck, 'De Vera Natura atque Indola Orationis Græcæ Novi Testamenti,' Gött. 1810, translated into English in the second volume of the 'Edinburgh Biblical Cabinet;' Alt, 'Grammatica Linguæ Græcæ qua N. T. Scriptores usi sunt,' 8vo., Halle, 1829; Middleton, 'Doctrine of the Greek Article applied to the Criticism and Illustration of the New Testament,' 8vo., third edition, Lond. 1833; Winer, 'Grammatik des Neutestamentlichen Sprachidioms, als sichere Grundlage der Neutestamentlichen Exegese bearbeitet,' 8vo., Leip. 1836. This is the best work on the language of the Greek Testament; the first edition was translated into English by Stuart and Robinson, 8vo., Andover, 1825. It also formed the basis of a new grammar, the 'New Testament Dialect,' by Professor Stuart of Andover, of which the part containing the syntax was printed in the 'Edinburgh Biblical Cabinet,' 1835. Tittmann, 'De Synonymis in Novo Testamento,' 8vo., Leip. 1829—32, translated into English by Craig in the 'Edinburgh Biblical Cabinet.'

Lexicons.—Budæi, 'Lexicon Græco-Latinum,' best edition by Constantinus; Stephani, 'Thesaurus Linguæ Græcæ,' 4 vols. fol., which was reprinted in London in 1816-1828, enlarged to 12 vols. folio; Scapulæ, 'Lexicon;' Hederici, 'Lexicon Græcum et Latinum;' Passow, 'Handwörterbuch der Griechischen Sprache,' 2 vols. 8vo., Leip. 1831; Donnegan's 'Greek and English Lexicon,' 8vo., with a notice of the same work in the 'Journal of Education,' No. 5; Hincks, 'Greek and English Lexicon,' 12mo., with a notice of the same in the Westminster Review, No. 28. The best Greek lexicon, in some respects, is that by Passow; from which the most valuable parts of Donnegan's 'Lexicon' have been taken. But Passow's 'Lexicon' is still very defective as to the etymology, and by no means free from great faults in the exhibition of the meanings of words. The Greek Lexicon of Stephens, 4 vols. folio, cannot yet be considered as superseded. The most useful dictionaries in studying an author are those which are written expressly to explain his language. The best of this kind are—Dammii, 'Lexicon Homericum et Pindaricum,' a work of small critical value; Schweighaeuser, 'Lexicon Herodoteum;' Sturz, 'Lexicon Xenophonteum,' 4 vols. 8vo., Leip. 1801—4; Wellauer, 'Lexicon Æschyleum,' 2 vols. 8vo., Leip. 1830—1; Ellendt, 'Lexicon Sophocleum,' 2 vols. 8vo., Regiom. 1834—5; Ast, 'Lexicon Platonicum,' the first volume was published at Leip. 1835; Schweighaeuser, 'Lexicon Polybianum;' Ernesti, 'Lexicon Technologiæ Græcorum Rhetoricæ,' 8vo., Leip. 1795; Schleusner, 'Lexicon in LXX. et reliquos interpretes Græcos Veteris Testamenti,' 5 vols. 8vo., Leip. 1820, reprinted at Glasgow, in 3 vols. 8vo. 1824; Schleusner, 'Lexicon in Novum Testamentum.' Schleusner's 'Lexicon to the New Testament' has been almost superseded by the more modern works of Wahl, 'Clavis N. T. Philologica,' 2 vols. 8vo., Leip. 1829; Bretschneider, 'Lexicon Manuale Græco-Latinum in libros N. T.' 2 vols. 8vo., Leip. 1829; and Robinson, 'Greek and English Lexicon to the New Testament,' 8vo., Boston, United States, 1836.

Literature.—Fabricii, 'Bibliotheca Græca,' edited by Harles [FABRICIUS]; Schoell, 'Geschichte der Griechischen Litteratur, von der frühesten zeit bis zur Einnahme Constantinopel's durch die Türken,' 3 vols. 8vo., Berl. 1828—31. This work is translated from the French of Schoell: the first vol. of the German edition, which is by Schwarz, is of comparatively little value; the second and third, by Dr. M. Pinder, are executed with more care, and contain considerable additions and corrections. Bentley, 'Dissertations on the Epistles of Phalaris;' Schlegel, 'Vorlesungen über dramatische Kunst und Litteratur,' 3 vols. 8vo., Heidelb. 1817 (the first volume contains an account of the Greek drama); Creuzer, 'Die Historische Kunst der Griechen in ihrer Entstehung und Fortbildung,' 8vo., Leip. 1803; 'History of the Literature of Greece,' by K. O. Müller, forming a part of the 'Library of Useful Knowledge,' of which four parts only have yet appeared; the article DRAMA in this work.

GREECE, KINGDOM OF, a new state of contemporary creation, consists of three great divisions, namely, Northern Greece, the Peloponnesus, and the Islands. The boundaries of Northern Greece, as determined by the commissioners of the three allied powers, Great Britain, France, and Russia, are formed by a line, somewhat tortuous, drawn across the continent from the gulf of Volo on the east, to that of Arta on the west, which is about 137 miles long, and defined by ninety-five landmarks placed on the most important points. The line begins at the mouth of the river Surbiotico, on the gulf of Volo, about 39° 11′ N. lat., and 22° 42′ E. long.; it then follows in a south-south-west direction the course of that river for about fourteen miles and a half, up to its source on the north slope of Mount Samendroula, from whence it runs along the crest of mountains known by the name of Othrys, for about 55 miles nearly due west along the line of division between the waters which flow northwards into the Salembria, the antient Peneus of Thessaly, and those which run southwards into the Hellada, or Sperchius. This part of the boundary is well defined by nature. On arriving at a place called the Tambour of Aiós Elias, about 22° E. long. and 39° N. lat., the boundary-line bends to the north, following a sharp turn of the ridge of Othrys for about five miles, to a table-shaped ridge called Zakharakhi Vrisi, which forms the connecting link of the chains of Othrys and Œta with the main chain of Pindus, and the point of division between the basins of the Aspropotamos, the Salembria, and the Sperchius, including their respective tributaries. This central spot, important in a geographical as well as in a political point of view, was ascertained to be about 11 miles north-east of Mount Veluki, the antient Tymphrestus, which had been hitherto supposed to be the connecting link between the three chains. This mountain however lies wide of Othrys, and is a part of the great chain of Œta, and from it an offset runs in a south direction, forming the lofty summit of Viena, in the centre of Ætolia, which Leake supposes to be the antient Panætolium of Pliny, and which rises to the north-east of lake Trichonis, one of the tributaries of the Aspropotamos, and divides the basin of that lake from the valley of the Fidaro, the antient Evenus. From the table-land of Zakharakhi the boundary-line follows in a north-north-west direction for about 13½ miles the crest of hills which form the western boundary of the great basin of Thessaly to Mount Itamo, a double-topped peak 5789 feet high, and covered with pines. It then crosses the valley of the river Mangiar, an affluent of the Aspropotamos, and follows the course of the Karitza, a tributary of the Mangiar, to its source at the foot of Mount Bugikaki, one of the Agrafiote range, 7759 feet high, and a southern projection of the great chain of Pindus, which divides Thessaly from Epirus. The Agrafiote mountains are of calcareous formation, but in the more northern parts of Pindus serpentine and granite are found in abundance. From Mount Bugikaki the boundary follows for six miles and a half in a west direction an elevated crest to Mount Tzornata, a projecting buttress of the Pindus range; and thence follows the course of the river Platanies to its junction with the Aspropotamos. After crossing the latter river it ascends the west slope of its valley, following the course of a mountain-torrent, called Stus Kapnus, to Mount Gabrovo (6479 feet), which is a part of the Chelona range that divides the basin of the Aspropotamos from that of the river Arta. From Mount Gabrovo it reaches the summit of the Chelona (6312 feet), and then descends gradually by a succession of ridges and plateaus to the river Combotis, which flows into the gulf of Arta. Following the course of the Combotis for about eight miles and a quarter in a westerly direction, it turns off to the south, and skirts the north-west offset or the Drimonari range of hills, then crosses the Doubsa, a tributary of the Combotis, and skirts the north-west base of the Macrinoros range, which bounds the east shores of the gulf of Arta, to a ruined place called Menidhi, where one of the offsets of the Macrinoros abuts upon the sea-shore. The line then crosses the gulf of Arta in a west-south-west direction, and reaches the low sandy promontory south of its entrance, called La Punta, the reputed site of Actium, which it intersects, and then terminates on the coast of the open sea a few miles to the north of the extreme point of the island of Santa Maura. (*Memoir on the Northern Frontier of Greece*, by Lieut.-Col. Baker, in the *Journal of the Geographical Society of London*, vol. vii., 1837, with a map; Col. Leake's map attached to his

Travels in Northern Greece, 4 vols. 8vo., London, 1837, has also the boundary-line marked upon it.)

The country south of the above line, extending as far as the isthmus of Corinth, forms the division called Northern Greece, and is bounded to the west by the Mediterranean, east by the Euripus, or Channel of Eubœa, and the Ægean sea, and south by the gulf of Corinth. It includes the antient territories of Acarnania and Ætolia, which are distinguished by the name of Western Greece, and those of Doris, Phocis, Bœotia, Attica, Megaris, the country of the Locri Opuntii, and the valley of the Sperchius, which constitute the division called Eastern Greece. The physical description of the country is found under the heads ACARNANIA, ÆTOLIA, ATTICA, BŒOTIA, PHOCIS, &c. The country is in great part mountainous. The principal range is that of Œta, which, beginning on the east on the coast of the channel of Eubœa, runs nearly due west across the country, joins the group of Mount Tymphrestus in Ætolia, and is only separated from the mountains of Acarnania and Epirus by the valley of the Aspropotamos. Offsets from the range of Œta connect it on the south with the ridge of Parnassus in Phocis, and with the mountains that border the northern coast of the gulf of Corinth, whilst to the south-east are the ridges of Helicon, Cithæron, and Parnes, the last of which separates Bœotia from Attica. The area of Northern Greece has been vaguely reckoned at 400 German geographical square miles, or about 8800 English square miles.

The country is divided, according to a very old municipal arrangement, which existed long before the Turkish conquest, into eparchies, or districts, which are subdivided into communes, or villages. Eastern Greece has eleven eparchies, namely: Attica, with 1 town and 118 villages; Megaris, 1 town and 12 villages; Thebais, with 150 villages; Libadia, 72 villages; Talantion, on the coast opposite Eubœa, 66 villages; Bendeniza, north-west of Talantion, 34 villages; Zeituni, in the valley of the Sperchius, 1 town and 29 villages; Patrarigno, 66 villages; Salona, near the Corinthian gulf, with 32 villages; Malandrinos, south-west of Salona, 16 villages; Lidoriki, in the valley of the Upper Cephisus, 60 villages. Western Greece has likewise 11 eparchies, namely: Mesolonghi, with 1 town and 2 villages; Anatolico, 2 villages; Zygos, 20 villages; Naupactos, or Lepanto, with 18 villages; Galaxidi, a town with a thriving trade; Baltos, 18 villages; Vonitza, 11 villages; Blokhos, with the town of Brakhorion, and 20 villages; Xeromeron, with 4 small towns and 23 villages; Krabara, with 2 towns and 53 villages; Apokouron, 26 villages; Karpenisi, 4 towns and 62 villages. The population is loosely estimated by families, the towns consisting, on an average, of 300 families, and the villages of 50 families. Eastern Greece is reckoned to contain 32,550 families, and Western Greece 19,000. If families are reckoned at four individuals each, which appears to be the average at present, the whole population of Northern Greece would be about 206,000.

The second great division of the kingdom of Greece is the peninsula of the Peloponnesus, or Morea, the area of which is nearly equal to that of Northern Greece, but is more densely inhabited, and better cultivated. It is divided into 35 eparchies, namely: Nauplia, with the town of that name and 64 villages; Nakhare, with the town of Cramidion and 3 villages; Argos, with 3 towns and 15 villages; Agios Petros, south of Argos, with 15 villages; Prastos, 5 villages; Corinth, 1 town and 17 villages, some of them considerable; Tripolizza, with 1 town and 61 villages; Leontari, in the plain of Megalopolis, with 1 town and 53 villages; Calabryta, north of Tripolizza on the borders of Achaia, with 1 town and 111 villages; Carytena, west of Tripolizza, with 1 town and 129 villages; Phanari, south of the Alpheus, with 2 towns and 52 villages; Androuza, or Andritzena, south of Phanari, 2 towns and 48 villages; Arcadia, near the coast on the borders of Triphylia and Messenia, with 1 town and 90 villages; Gastouni, in the fine plain of Elis, with 7 towns and 172 villages; Pyrgos, south of Gastouni, near the mouth of the Alpheus, 1 town and 9 villages; Vostitza, in Achaia, with the town of that name and 9 villages; Patras, 1 town and 112 villages. In the south, Messenia contains 7 eparchies, namely: Neocastro, or Navarin, with 1 town and 14 villages; Modon, 1 town and 28 villages; Coron, 1 town and 56 villages; Nesion, near the mouth of the Pamisus, 1 town and 2 villages; Calamata, 1 town and 17 villages; Micromani, 1 town and 10 villages; and Embelakia, with 2 towns and 35 villages. The territory of antient Laconica contains the eparchy of Lacedæmon, with 21 towns or burghs (Koryopolæ) and 108 villages; Monembasia, with 3 towns and 30 villages; and in the eastern mountains are the eparchies of Trigonas, Malembria, Phoukas, and Kolokythi, reckoning altogether about 10,000 families. In the mountains of West Laconica or the Taygetus ridge are the eparchies of Stauropygos, near the borders of Calamata, with 1200 families; Androbysta, 800 families; Zygos, 1200 families; Mylea, 500 families; and southernmost of all, in the narrow rocky peninsula which terminates at Cape Matapan, is the eparchy or district of Maina, with 3000 families, whose chief is styled Bey. The name of Mainiotes is often given to all the mountaineers of West Laconica, but the inhabitants of the district of Maina reserve it for themselves exclusively, calling their neighbours by the name of their respective eparchies. A description of the physical geography of the country is given under the respective heads ACHAIA, ARCADIA, ARGOLIS, ELIS, LACONICA, &c. The whole population of the Peloponnesus is is reckoned by Thiersch at 108,000 families, which, taking an average of 4 individuals for each, makes 429,000 inhabitants, although the Commission of Statistics established by Capodistria in 1828 estimated it only at about 370,000. Before the war of Independence the population both of the Peloponnesus and of Northern Greece was much greater. Several eparchies have lost more than one-half of their numbers by death or emigration; and the Turkish population has entirely disappeared.

The third great division of Greece consists of the islands in the Ægean Sea, including the Cyclades and the Sporades, besides the large island of Eubœa, which Thiersch states to contain 20,000 inhabitants, an estimate apparently too low, though it is known that the island has lost more than one-half of the population which it had before the revolution. [EUBŒA.] The other inhabited islands are distributed as follows:—1. The Western Sporades, namely, Hydra, with 20,000 inhabitants, having lost the greater part of its former population by emigration, owing to the losses suffered and the sacrifices made by its merchants during the war of Independence; Spezia, with 18,000; Ægina, 5572; Poròs, 4464; Salamis, 1124; Angistra, 1552. 2. The Northern Sporades, namely, Scopelos, 6515 inhabitants; Khilidromi, 240; Skiathos, 1532; Skyros, 1578. 3. The Northern Cyclades, namely, Andros, 5000 inhabitants; Zea, 3112; Thermia, 2050, Tino, 22,000; Mikoni, 4012; Syra, 30,000, the most flourishing island of Greece. 4. The central Cyclades, namely, Naxos, with 10,800 inhabitants; Paros and Antiparos, 4751; Siphnos, or Siphanto, 4431; Seriphos, 3200; Milo, 1458; Kimolos, 420; Polikandro, 1200; Sikino, 1100; Nio, 2177; Amorgo, 2567. 5. The Southern Cyclades *i.e.* Santorin, 9656; Anaphi, 643; and Astypalæa, with 951. Chios, Samos, Lesbos, and the other islands near the coast of Asia Minor, still belong to Turkey; and Crete has been given to the Pacha of Egypt.

The whole population of the islands belonging to the kingdom of Greece (which is better ascertained than that of the continent) is reckoned at about 176,000, which, added to the 206,000 of Northern Greece, and the 429,000 of the Peloponnesus, gives a total of 811,000 for the population of the whole kingdom. Others reckon it much lower, and not quite 700,000; but all this seems to be a matter of guess. Thiersch states that the plains alone of Greece, which are now in great part deserted, could employ and support 500,000 families of fresh cultivators.

The three divisions of the kingdom are inhabited by populations differing in their physical and moral character. The inhabitants of Northern Greece are distinguished by the name of Roumeliotes, while those of the Peloponnesus are styled Moreotes, and there is but little sympathy between the two. The Roumeliotes are a military people who have maintained in the mountains of the interior a sort of wild independence, which the Turks could never entirely subdue. Their manners and habits are simple, and remind one of the primitive ages of Greece. The Moreotes, on the contrary, with the exception of Maina, had completely submitted to the Turkish yoke; and their archontes, or primates, shared with the pachas and other agents of the Porte the spoils of their own countrymen. The Moreotes have not in general the frank boldness of the Roumeliotes, although they assume an arrogant tone when they can do it with impunity. In Roumelia the population of the mountains of Parnassus, Agrapha, Baltos, Xeromenos, and other interior parts of Ætolia, is of Hellenic stock; but the peasantry of the plains are chiefly Valachians, Bulgarians, or

Albanians, and are a steady quietly-disposed people. There are also the Capitani, or military leaders by profession, half soldiers, half klephts, who put one in mind of the Condottieri of the middle ages, and who have at their command bands of Palikari, young men, orphans or forsaken, whom they treat as adopted sons, and train up to their profession. In the towns near the coasts the population is a mixture of many races.

In the Peloponnesus the Albanian race occupies Argolis and Triphylia; the rest of the population speak Greek. The peasantry in the plains are not proprietors, all the land belonging either to the state or to the wealthy families of the primates or archontes. In the mountains there is a great number of small proprietors, generally thrifty and industrious husbandmen, and their dwellings are much better than those in the plains; many have neat gardens around them, especially in Arcadia and Laconica. In the towns the population is as mixed as in those of Roumelia, consisting in great measure of families who emigrated from various parts of the Levant, after the Turkish conquest, to exercise various trades, or to manage the affairs of the Beys and other wealthy Turks. There were not in the Morea any capitani, or military chiefs by profession, as in Roumelia, though some sprung up during the war of Independence; but since the peace their peasant recruits have returned to the labour of the fields.

In the islands there is a mixture of Albanians and Greeks, and descendants of the Latin invaders of the middle ages. The Albanian race inhabits almost exclusively Hydra and Spezia: the Chiote and Psariote emigrants, who now inhabit Syra, are of Hellenic descent. At Naxos, Santorin, and some other islands, there is a kind of territorial nobility, who date from the time of the Crusades, and belong to the Western or Latin Church: their lands are cultivated by a Greek peasantry. At Tinos the peasantry are proprietors, and cultivate their lands with great care. Mikoni and Milo are inhabited by active and thriving sailors and traders.

Besides these races, there have been since the Revolution large immigrations of military refugees from various parts of the Turkish empire, such as the Candiotes, who came to the number of 4000; the Souliotes, from Epirus who continue under their hereditary chiefs, Zavellas, Bozzaris, &c.; the Olympiotes, from the mountains between Thessaly and Macedonia, who retreated before the Turks and sought shelter within the Straits of Thermopylæ, where they remained under their capitani, to the number of several thousands, and mainly contributed, with the Roumeliotes, to the overthrow of the Capodistria administration. These armed bands were still, when Thiersch was in Greece in 1832, a source of considerable uneasiness to the government, which could not employ them all, and they lived at the expense of the peasantry of the various districts where they had quartered themselves.

There is moreover a mixed body of Fanariotes from Constantinople, some of whom are well-informed men, but generally speaking they are in bad odour with the people; of emigrants from the Ionian Islands, who came chiefly to fill up the offices or seek their fortune under their countryman Capodistria's administration, and who are likewise in very bad repute; of Asiatic Greeks, Epirotes, and adventurers from Italy, France, and other parts of Western Europe. (Thiersch, *De l'Etat Actuel de la Grèce*, vol. i., part 2, 3rd section, 'On the Character and Habits of the various people who inhabit Greece.')

'From the oldest times the organization of society in Greece has been based on paternal authority. A father decides absolutely on the destiny of his children, their profession, marriages, &c., without even consulting them; and in some instances, assisted by a family council of his nearest relations, he exercises the power of life and death over them. It is only two years ago, writes Thiersch in 1833, that an instance of this occurred at Argos, where a father condemned his daughter to be buried alive, because she had allowed herself to be seduced, and the sentence was carried into execution as a matter of course. The prefect being informed of the deed, though too late, imprisoned the father, but the next day the numerous relatives and other inhabitants of Argos, led by the parish clergyman, loudly protested against the interference of the civil authority, saying that the father had only exercised his incontrovertible right. In the result, the accused was tried by the tribunals and condemned merely to two years' imprisonment.' (Thiersch, vol. ii., sect. 22.)

Most of the country population of Greece live in villages, for the sake of security and mutual protection. Once a year the heads of families assemble in the church to elect their demogerontes, or municipal magistrates, one in every village or commune, and three for a town. The demogerontes act as justices of the peace and also as treasurers of the commune, have no emoluments, and are generally chosen among the archontes, or notables, of the place. The archontes are those who live upon their landed income without exercising any trade; they form in fact the aristocracy of Greece. At the end of the year the demogerontes give an account of their administration and show their accounts, after which they are either confirmed in their places, or new ones elected, generally upon the recommendation of their predecessors in office. A communal council, consisting of those who have filled the office of demogerontes and of the other notables, assists them in their functions, in laying the local taxes, &c. The Turks did not interfere in these local arrangements, which suited both their indolence and their rapacity, and the demogerontes became in fact their collectors; they paid into their hands the amount required of the commune, for which they assessed the respective inhabitants often much beyond their fair quota, being sure of being protected by the Turkish authorities. By the Revolution these abuses disappeared in a great measure; the communes, having recovered their independence, were able to check any undue exercise of authority on the part of their demogerontes, though still the influence of the latter remained very great. This independent communal system did not suit the views of the president Capodistria, who, adopting the French system, caused lists to be made out, by the prefects or political officers of the district, of the persons whom they judged qualified to fill the office of demogerontes. The result was, to have at the head of each commune none but creatures of the government. After the fall of the Capodistria administration the communes resumed their rights, dismissed the existing demogerontes and elected others. Thiersch gives some interesting details of the municipal governments of several of the islands, Hydra, Chios, Psara, &c., which even under the Turks were in fact so many republics, some democratic, such as Chios, and others aristocratic, such as Hydra, but all governing themselves entirely by their own laws and through their own magistrates and judges.

Deputies from the communes assemble at the chief town of the eparchy, or district, to elect three or more eparchical demogerontes, who, joined to the local demogerontes of the place, constitute a council which concerts measures with the prefect or political authority concerning the police, the assessment of taxes, and other matters affecting the whole district.

The resources of the continental part of the kingdom are derived chiefly from agriculture. There are about 120,000 families of cultivators of the soil, of which 20,000 are proprietors. According to the returns of 1829, there were in Northern Greece 2,883,000 stremata of cultivated land, which is not one-twelfth part of the surface of the country. The strema is a square of 40 paces on each side, and the value of a strema of cultivated land to a purchaser varies from 2*l.* 10*s.* sterling to 14*l.*, according to the various districts. Of the above quantity of land under cultivation about one-third was national property, which formerly belonged to the Turkish government or to the mosques. The vineyards are almost all private property. There are also about 215,000 olive trees, chiefly in Attica, Megaris, and the eparchy of Salona, a great part of which is national property. It must be observed that the returns as to the value of land were very inexact, the peasantry having an interest in underrating their property. In the Peloponnesus the returns were still more defective, but there were understood to be about ten millions of stremata of cultivated land, of which more than two-thirds were national property. In Eubœa, almost all the land, being owned by the Turks, came by the revolution into the hands of the state, which has sold part of it. In the other islands the land is all private property. Greece produces about two-thirds of the corn required for its consumption. Wheat, barley, and Indian corn are the species cultivated: oats and rye are not in use. Tobacco thrives, especially near Argos and Calamata, and cotton grows also in considerable quantity. The wine made is enough for the home consumption; it is generally good-bodied, but for want of proper management in making it, and of cellars, it does not keep beyond a year or two. Currants are cultivated in various districts, espe-

cially in the eparchies of Patras and Vostitza, and are of excellent quality. This branch of culture is susceptible of great amelioration and extension. The olives are of good quality, but the art of pressing and refining the oil is very imperfectly understood, and the oil is inferior to that of Provence. Silk is made in Messenia and Laconica, and also at Tinos and in other islands, but is inferior to the Italian silk. Of fruit-trees, the almond, the fig, the chestnut, the orange, and the lemon thrive the best. Horned cattle are not numerous, nor sufficient for the labours of the field, for which they are almost exclusively used, and oxen are imported for that purpose from Thessaly and Asia Minor. There are however numerous flocks of sheep and goats, which migrate to the mountains in the spring, and return to the plains after the harvest. The produce of wool is considerable, but of a coarse kind, and is used chiefly for home manufacture. Pigs are scarce, except in Arcadia, and their flesh is not deemed wholesome. The only milk used is that of ewes and goats, and the butter and cheese made of it is very inferior. Asses are employed almost exclusively as beasts of burthen; the horses are of a strong breed, but neglected.

The fine forests with which the mountains were once clothed have been sadly wasted, and for the most part entirely destroyed, in great measure by the carelessness or wanton rapacity of the inhabitants themselves, and the mountains are now naked and barren, and the springs dried up in consequence. Forests however remain still on the Taygetus, on Mount Cronion and other mountains of Arcadia, on those of Megaris, on the ridges of Parnassus and Helicon, and on part of the Œta range. The pine is the most common timber-tree, but fine oaks are found in the northern mountains near the borders of Thessaly.

The commerce and navigation of Greece are centred in the ports of Nauplia, Mesolonghi, Patras, Galaxidi, and the islands of Hydra, Spezia, and, above all, Syra, where a handsome town has risen since the war, with churches, schools, hospitals, docks, warehouses, lazzarettos, and companies of insurance, chiefly the work of the emigrants from Chios and Psara, who escaped from the massacres of the Turks in 1824. The number of Greek merchant vessels in 1832 amounted to above 1000, exclusive of small craft, or coasting-boats. The merchants, generally speaking, have not large capitals, but they assist each other, and are also assisted by their wealthy countrymen, who are established all over the Levant and in the ports of the Mediterranean. The extensive line of coast and the numerous islands supply a multitude of good sailors, active, hardy, and frugal. The principal traffic of the Greek vessels is the carrying trade between the ports of the Mediterranean and the Black Sea.

The events of the Greek revolution, which began in 1820, and of the war between the Greeks and Turks, which lasted ten years, till the end of 1829, are well known through the works of Leake, Stanhope, Blaquiere, and numerous others. The Greeks were determined to shake off the Turkish yoke, and they succeeded in clearing the Morea of their enemies and defeating them by sea. The Porte, unable to subdue them, called to its assistance the disciplined forces of the pacha of Egypt, which invaded the Peloponnesus, and the cause of Greek independence had again become problematical, when the three powers, Great Britain, France, and Russia, resolved to put a stop to this war of extermination, which had been carried on for so many years. The victory of Navarino gained by the allied fleets in October, 1827, obliged the Egyptian forces to evacuate the Morea. The Conference of London, in March, 1829, established the principle of the independence of Greece as a state, and the successful campaign of the same year of the Russians against the Turks induced the sultan to acknowledge it by an article of the treaty of Adrianople, in September, 1829. In January, 1830, the Conference of London settled the total independence of Greece from the Porte, and fixed Thermopylæ and the Aspropotamos as the frontiers of the new state, which were afterwards extended in 1832 to the present boundary line, with the consent of the sultan. Meantime the internal government of Greece had undergone many vicissitudes. During their arduous struggle against the Turks the Greeks had called together at Trœzen a congress of deputies from the various districts, which settled the basis of a constitution; but the vicissitudes of the war prevented the government from assuming a fixed and orderly shape. When the independence of Greece was secured by the interference of the three allied powers, the congress appointed Count John Capodistria, a native of Corfu, who had been employed with distinction as a diplomatic agent of Russia, to be the head of the executive of the new state of Greece, with the title of President, for seven years, and with very extensive powers. Capodistria arrived in Greece in February, 1828, and he set about establishing a central system of bureaucracy as in France and Russia, by which the government was to interfere in and regulate at pleasure all the concerns of society, civil, financial, commercial, municipal, and religious. Unfortunately for his plan, the Greeks, even under Turkish despotism, had been used to much individual freedom, and to have the direction of their own municipal, judicial, and commercial affairs, under the guidance of their archontes and clergy: the Turks lived chiefly in the fortified towns, interfering but little in the internal concerns of the rayahs, and employing the archontes themselves to exact whatever they wanted from the people. The result of Capodistria's rash measures was an insurrection, which began in Maina and Hydra, and soon extended to most of the islands, and to the warlike population of Roumelia.

The complicated events of the civil war are related by Thiersch in the first volume of his work. On the 8th October, 1831, Capodistria was murdered at Nauplia in open day, on the threshold of the church of St. Spiridion, by George and Constantine Mauromicali, the relatives of Petros Mauromicali, the bey of Maina, whom the president had kept for a long time in prison without bringing him to trial. [CAPODISTRIA.] His brother Augustin Capodistria succeeded him in the presidency, but the civil war continuing, he was obliged to resign. At last the allied powers offered the crown of Greece, which had been refused by Prince Leopold of Saxe Coburg, to the king of Bavaria for his younger son Otho, then a minor, and the offer being accepted, Otho, accompanied by a council of regency, and a body of Bavarian troops, arrived at Nauplia in February, 1833, and was willingly acknowledged by the Greeks as their sovereign. In June, 1835, king Otho, being of age, took the direction of the affairs of state. The government is a constitutional hereditary monarchy, with two legislative houses—a senate, and house of representatives. In the year 1836 King Otho made a journey to Germany, where he married Amelia Maria, daughter of the grand-duke of Oldenburg; and in February, 1837, he returned with his bride to Greece, and made his entrance into Athens, the capital of the kingdom, in the midst of general acclamations. It is settled that the children of this marriage shall be brought up in the Greek communion. Since the arrival of king Otho Greece has been comparatively quiet, bating some intrigues and dissensions between the Roumeliote chiefs, the Moreote primates, and the old klepht Colocotroni. The greatest difficulty under which the state labours is want of money, the revenue amounting to but one-half of the expenditure. The loans or subsidies guaranteed by the allied powers have till now made up the deficiency. The sale of national property, if judiciously managed, offers an available resource for the future. The principal source of revenue is the tithes, the government exacting one-tenth of the produce of all private lands, and one-fourth of that of national lands. This tax is sold every year by auction to contractors in the various districts, who pay to the government a certain sum in money by instalments, and collect the tax in kind from the farmers, making thereby a considerable profit, which has been estimated on an average at 40 per cent. (Thiersch, vol. ii., sec. 26.) The archontes, or primates, are generally the contractors, and the system is a fruitful source of oppression. By establishing local collectors, and making a just valuation of the lands, this source of revenue might be doubled without detriment to the agriculturists. The other sources of revenue are the customs, collected chiefly at Syra; the leases of mills, warehouses, shops, and houses, belonging formerly to the Turks in the fortified towns, such as Modon, Coron, Monembasia, Negropont, Lepanto, Acrocorinth, &c., which are now national property; the sea-salt pans and fisheries, &c. With regard to the indirect taxes upon markets, cattle, inns, shops, &c., they are appropriated to the local expenditure of the communes.

The above statistical details are given from Thiersch, who was in Greece in 1832; things may have somewhat altered since that time; but still, by all accounts, much remains to be done in Greece, in order to establish an orderly

and prosperous state of society. Good elements are not wanting:—a fertile soil, a fine climate, a favourable situation, and an intelligent and spirited though uninformed and long degraded population. Popular education is still in its infancy, though something has been done to favour it; elementary books are totally wanting. Accounts of the then existing establishments for education in Greece are given in several Nos. of the 'Journal of Education.'

GRECIAN ARCHITECTURE. [CIVIL ARCHITECTURE.]

GREEK CHURCH. The Greek or Eastern Church is that part of Christendom which separated from the Roman or Western Church in the ninth century. Even previously to that epoch there were several dissensions between the patriarchs of Constantinople and the popes of Rome, who claimed a supremacy over all the churches of Christendom; but the decided breach between the two churches dates from the year 862, under the patriarch Photius. The extension of the Greek Church by the conversion of the Bulgarians and some other Sclavonian nations excited the jealousy of the popes, who moreover having found a new support in the establishment of the Franko-Roman empire, began to act with more boldness against the emperors of Constantinople. Photius reproached the Western Church with the wanton addition of the word 'Filioque' ('and the son,') to the words 'I believe in the Holy Ghost the Lord and giver of life, who proceedeth from the Father,' contained in the Nicene creed, and which he declared to be an antiscriptural doctrine. He reproaches them also with having introduced several innovations unknown to the primitive Christian church; as, for instance, the celibacy of priests, the repetition of the anointment, with the chrisma (confirmation) and the fastings on Saturdays; but he particularly inveighed against the assumption of the Roman bishops in considering themselves as the head of all Christendom and treating the Greek patriarchs as subordinate to them. The final separation however of the Eastern from the Western church did not take place till 1054, under the patriarch Michael Cerularius, who, in addition to the matters alleged by Photius, attacked the Latins for using unleavened bread at the communion, and for the profligacy of their clergy, &c., for which he was excommunicated by Pope Leo IX. The attempts at uniting the two churches, which were made either by the popes, in order to extend their dominion over the East, or by the emperors of Constantinople, who, being pressed by the Mohammedans, sought assistance from the Western powers, generally failed through the pride and interested motives of the leaders of both the parties. While Roman Catholicism was gradually developing itself under Gregorius VII. and his followers, as well as by the aid of the scholastic philosophy, the Greek church remained stationary in its organization as well as in its rules of doctrine, as laid down, 730, by John Damascenus. (Ἔκδοσις ἀκριβὴς τῆς ὀρθοδόξου πίστεως.)

The capture of Constantinople by the Latins in 1204, and the oppression of the Greeks during their sway, were calculated to widen the breach between the two churches. Michael II. Palæologos, who expelled the Latins from Constantinople in 1261, was inclined to effect a union with Rome, and his ambassador, with some Greek clergymen devoted to him, acknowledged the supremacy of the pope at the council of Lyon (1274), and to confirm this acknowledgment a synod was convoked at Constantinople in 1277. But the bulk of the Greek church being opposed to the measure, and the Pope Martin VI. having excommunicated the emperor Michael, from political motives (1281), the separation from the church of Rome was solemnly confirmed by the synods of Constantinople, held in 1283 and 1285. The last attempt at uniting the two churches was made by the Emperor John VII. Palæologos, who, being driven to extremity by the Turks, came to Italy, and, at the council of Florence, in 1438, acknowledged the supremacy of the pope. This union was however not accepted either by the Greek clergy or by the people; but the constant efforts of Rome to attain this great object resulted in bringing to her many Greek churches in various parts of the world, and particularly in Hungary and Poland.

The Greek Church, like the Roman Catholic, acknowledges a double foundation of faith—the Bible, and tradition. Under this latter appellation it comprehends such doctrines as are supposed to have been verbally taught by the apostles, and which were confirmed by the Greek fathers of the church, and by John Damascenus, as well as by the first seven Œcumenic Councils of the Church (the 1st and 2nd of Nicæa, the 1st, 2nd, and 3rd of Constantinople, and those of Ephesus and Chalcedon). It forbids the patriarch and the synods to introduce any new dogma; but considers a full belief in those already established as indispensable to salvation. It maintains that the Holy Ghost proceeds only from the Father, differing in that point from the Roman Catholic church as well as from all Protestant churches, which admit the proceeding of the Holy Ghost from the Father and the Son ('Filioque'). Like the Roman Catholic church it admits seven sacraments: baptism; the chrisma; the communion, preceded by auricular confession; penitence; priesthood; matrimony; and extreme unction. But it differs from the Western church in the following points. 1. That baptism, in order entirely to remove original sin, should be performed by immersion of the body three times in water; and that the chrisma, which it considers as the completion of baptism, should be administered at the same time. 2. Although it admits the doctrine of transubstantiation, it prescribes the communion of two kinds, which is administered with leavened bread; and the wine, which is mixed with water, is not given from the cup as among the Protestants, but put by the priest with a small spoon into the mouth of the communicant. 3. It requires from the secular clergy, as a necessary condition for receiving ordination, marriage with a virgin, but a priest who loses his wife cannot marry again; nor can a person be ordained priest who has been married more than once, or who has married a widow. It allows laymen to contract marriage only three times, and is very strict in regard to degrees of consanguinity, and it also establishes, in addition to the connection by blood, a spiritual affinity between sponsor and god-child. 4. It admits no purgatory. Besides the above-mentioned important points, the Greek differs from the Roman church in several other matters of small moment. Thus, for instance, it allows the anointing of the body with the chrisma, not only to persons threatened with death, but to all sick persons as a means for restoring their health and obtaining the pardon of their sins. Although it admits no purgatory it is customary with many of its followers to give the deceased a written testimony from the priest of his religous conduct, in order thereby to facilitate his entrance into paradise. This however is evidently a custom transmitted from the ancient Greeks, and it must be considered as a practice rather connived at than prescribed by the Greek church. The same church admits no works of supererogation, neither does it acknowledge any vicar of Christ like the pope of Rome. Having retained the Decalogue unmutilated, it forbids, conformably to the second commandment, all kinds of carved images, but it permits and encourages paintings representing the Deity, the Holy Virgin, and saints.

The followers of the Eastern church are no less zealous than the Roman Catholics in invoking saints, particularly the Holy Virgin, and in their veneration of relics. Their fasts are much more numerous and strict than those of the Roman Catholics. Besides Wednesday and Friday in every week they have four great fasts in the year: Lent, or the fast of 40 days before Easter; another fast which lasts from Trinity day to the feast of St. Peter and Paul, 29th of June; a third which continues from the 1st to the 15th of August; and a fourth beginning at St. Philip's day, on the 15th of November, and ending at Christmas.

During all this time they abstain not only from meat but also from milk, butter, and eggs. The ritual of the Greek church consists almost entirely of outward ceremonies, and preaching or religious instruction is scarcely ever used. In addition to the mass, which forms the most important part, the liturgy consists in reading several passages of the Scriptures and a repetition of creeds and prayers which the officiating priest begins and which are responded by the congregation. Every congregation has a choir which sings psalms and hymns, but the congregation takes no part in them. Instrumental music is entirely excluded from divine service.

The Greek convents follow the strict rule of St. Basilius. The abbot of a Greek convent is called Higumenos, and the abbess Higumena; the abbots who superintend several convents have the title of Archimandrite, and rank next to bishops. All the high ecclesiastical dignities, as bishops, archbishops, and metropolitans, are chosen from the regular clergy; while the secular can rise only to the rank of Protopapas, which is only one degree higher than that of an ordinary priest.

The Greek church under the Turkish dominion has preserved almost entirely its antient organization. It is governed by the patriarchs of Constantinople, Alexandria, Antioch, and Jerusalem, of whom the first, as the Œcumenic patriarch, presides over the general synods of Constantinople, which are composed of the above-mentioned patriarchs, several metropolitans and bishops, as well as twelve eminent Greek laymen. He exercises a supreme ecclesiastical authority over all the Greeks of the Ottoman empire, and is also acknowledged as the head of their church by the inhabitants of Austria and the Ionian islands who profess the Greek religion. The other three patriarchs, whose dioceses are filled with Mohammedans, have exceedingly small flocks. The patriarch of Alexandria rules only over two churches at Cairo. When Greece was constituted an independent state its president Capodistria established a supreme ecclesiastical council, consisting of three bishops, which declared itself independent of the patriarch of Constantinople in the administration of the external affairs of the church, but acknowledged his authority in matters of faith. This organization was confirmed by a synod convoked on the accession of the present king.

The Russian church, which now constitutes the most important branch of the Greek church, is noticed in the article on that country.

A complete catechism of the Greek church was composed by Peter Mogila, archbishop of Kioff, who presented it in Greek and Latin, to the Greek synod assembled in 1643 at Jassy. The synod approved of it, and sent it to all the Greek patriarchs for final confirmation. But before this confirmation was given the author printed it at Kioff in Polish and in Russo-Polish, 1645. A second edition of it appeared at Leopol in 1646, and a third at Moscow in 1649 in the same Russo-Polish dialect, with the explanation of many words in the Muscovite dialect. The Greek copy was published by Nicosias Panagiotes, chief dragoman of the Porte, in 1662, at Amsterdam, in order to be distributed gratis among the Greeks of the Ottoman empire. A second edition was also published at Amsterdam in 1672 by order of Dionysius, the patriarch of Constantinople, and it was also printed at Bucharest in 1699. The Amsterdam edition was translated into the Sclavonian language at Moscow, and printed there in 1696, and it has been reprinted many times in Russia. The same edition of Amsterdam was translated into Latin by Laurentius Normann, bishop of Gothenburg, in Sweden, and published, with the Greek text and an introductory preface, at Leipzig in 1695. A German translation of the same Catechism, by Leonard Frith, was published at Berlin in 1727. The Greek text, with the Latin translation of Normann, and the German of Frisch, was published at Breslau in 1751, by Karl G. Hofmann, who prefixed to it an historical notice.

A Russian learned divine named Peter Alexeyeff, undertook to publish at Moscow, in 1781, the edition of Hofmann, with the addition of the Sclavonian translation, and with some learned notes, but only a part of it was published, the remainder being stopped by ecclesiastical authority on account of some bold remarks which the editor expressed in his notes.

GREEK MUSIC. [MUSIC, HISTORY OF.]

GREEN. [LIGHT.]

GREENE, MAURICE, Mus. Doc., who as a composer of English Church music is second to none, and indeed has scarcely a rival, was the son of the Vicar of St. Olave Jewry, London, and born at the latter end of the 17th century. He received his education in St. Paul's choir, under Brind, the organist, from whose instructions, aided by his own strong genius and remarkable industry, he profited so well, that he was elected organist of St. Dunstan's in the West before he had completed his twentieth year. In 1718 he succeeded his master in the important situation of Organist to St. Paul's Cathedral. On the death of Dr. Croft, in 1726, he was appointed organist and composer to the Chapel-Royal; and in 1736 was presented to the office of Master of His Majesty's Band, on the decease of Eccles, a name familiar to all who are acquainted with the dramatic history of this country during the conclusion of the 17th and the beginning of the 18th century. Previously to the latter promotion, the degree of Doctor in Music was conferred on him at Cambridge, his exercise for which was Pope's Ode on St. Cecilia's Day, the author having, at the request of Greene, made considerable alterations in his poem, and added a new stanza. This, however, forms no part of the ode in any edition of the poet's works, and seems indeed to have been written *invitâ Minervâ*. The university shortly after elected the composer Professor of music, on the death of Dr. Tudway.

Dr. Greene took an active part in all musical affairs, and when Handel finally settled in this country, the English musician courted his acquaintance assiduously; but having taken some offence, he soon became one of the great master's bitterest enemies. He supported Bononcini (the same person that is immortalized in Swift's epigram), who was enabled, through the influence of Henrietta, Duchess of Marlborough, and a strong party of the nobility, to get elevated to the rank of one of Handel's ephemeral rivals, and introduced him at the Academy of Antient Music, where the Italian practised a deception which caused his expulsion; on which Greene retired, and established another concert at the Devil Tavern. Handel, hearing of this, exclaimed, 'De toctor Greene is gone to de Tefel!' The hostility of the angry Briton to the illustrious German composer is accounted for, with some appearance of reason, by Dr. Burney, who says, 'Handel was too prone to treat inferior artists with contempt. What provocation he had received from Greene after their first acquaintance, when our countryman had a due sense of his vast powers, I know not; but for many years of his life, he never mentioned him without some injurious epithet.' An enemy is always a suspicious critic; and though it is well known that Handel spoke disparagingly of Greene's compositions, yet he must secretly have entertained a high opinion of their merits. His sarcasms were perhaps directed at Greene's lighter works: of his church music he could never have thought contemptuously.

In 1750 Dr. Greene came into possession of a good estate in Essex, left him by his paternal uncle, a serjeant-at-law. He then resolved to digest and publish a collection of the best English Cathedral music, and in five years made considerable progress in his favourite undertaking; but his health beginning to fail, he delivered his materials to the care of his friend and disciple, Dr. Boyce, who completed the work, and gave to the world the matchless volumes so well-known to every real amateur of classical English music. Dr. Greene died in 1755, leaving one daughter, married to Dr. Michael Festing, rector of Wyke-Regis, Dorsetshire. He was, as Dr. Burney, who knew him, informs us, in figure 'much below the common size, and had the misfortune to be deformed; but his address and exterior manners were those of a man of the world, mild, attentive, and well-bred.' He enjoyed the friendship of Bishop Hoadley, at whose table he was always a welcome guest; and his interest with the Duke of Newcastle, of political memory, was strong. Among his compositions are some charming cantatas and songs; but his fame is built on his *Forty Anthems for one, two, three, four, five, six, seven, and eight voices*, in two folio volumes. 'These,' says a writer in *The Harmonicon*, 'place him at the head of the list of English Ecclesiastical composers, for they combine the science and vigour of our earlier writers, with the melody of the best Italian masters who flourished in the first half of the 18th century.' To Greene our cathedral establishments owe a great debt of gratitude: his works constitute a very large portion of their musical wealth; and as the harmony heard in those venerable edifices attracts numbers to them, Dr. Greene, as well as some few other composers for our church, ought, in strict justice, to be ranked not only as skilful musicians, but among the promoters of the national religion.

GREENFINCH, one of the English names for the well known indigenous *Green Linnet*, *Green Grosbeak*, or *Green Bird*; *Verdier* of the French; *Verdone*, *Verdero*, *Antone* of the Italians; *Grünfinck*, *Grüner Kernbeisser*, *Grünling*, and *Groenling* of the Dutch and Belgians (Netherlanders); *Swenska* of the 'Fauna Suecica;' *Y Gegid*, *Llinos werdd* of the antient British; *Loxia Chloris*, Linn.; *Fringilla Chloris*, Temm.; *Coccothraustes Chloris*, Fleming.

Varieties.—Pure white or yellowish, often variegated with yellow and white.

Geographical Distribution.—Common in almost all European countries.

Habits, Food, &c.—Haunts gardens, hedges, orchards, bushy places, rarer in the woods. *Food* consisting principally of the smaller seeds. *Nest* in trees (ivied generally), bushes, or hedges; eggs four to six, white, with rusty-red speckles at the larger end. *Song* not disagreeable; but

the bird is valued in confinement more for its extreme docility, and the pretty manner it has of showing its attachment, than for its vocal qualities, though it may be taught to repeat words.

Mr. Gould is of opinion that this bird is a true Grosbeak (*Cocothraustes*) at the extreme limits of which genus he considers that it ought to be placed, and where it would appear to form a union with the true species of *Fringilla* as restricted by authors of the present day.

HYBRIDS.

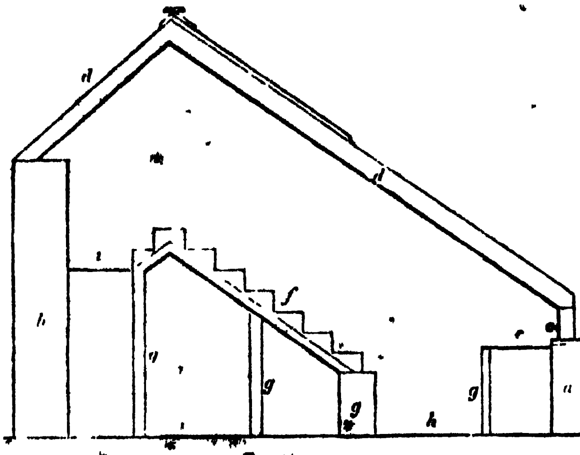
For an account of the *mules* bred between a *hen-canary* and a *greenbird*, see CANARY BIRD, vol. vi., p. 228.

GREENHOUSE, a building for growing and protecting those kinds of plants which are too tender to live in the open air. Structures of this kind were formerly erected with slated roofs, like dwelling-houses, and with large upright windows in front, divided and supported by pillars; examples of which may yet be seen in several of the royal gardens about London, and also in different parts of the country. It was soon found that handsome specimens of plants could not be grown in houses of this description, and the only purpose to which they are now applied is the growing of orange or lemon-trees, and protecting other plants in winter. [CONSERVATORY.]

Sometimes greenhouses are built with the front and back entirely of brickwork, and with glass sashes on the top and ends; these, though better than the last, are by no means to be recommended.

By far the best kind of greenhouses are those with span-roofs, which should be built in the following manner:—a neat wall, about three feet high, should be built round the front and ends; the back wall should be about two-thirds of the height of the roof. Along the top of the front wall a row of glass sashes, eighteen inches in height, must be placed upon the brickwork, which will raise the front to four and a half feet. The span-roof will then be supported upon this in front, and its back sashes will rest upon the back wall.

This will be better understood by the following plan:—



a, front wall, three feet high; *b*, back wall; *c*, upright sashes in front; *d d*, span roof; *e*, shelf along the front for plants; *f*, stage for plants; *g*, supports to the stage; *h*, passage in front; *i*, passage in order to water the plants upon the top.

A greenhouse should always, if possible, front the south; the best situation is in the flower-garden, but it is sometimes found more convenient to have it joined to the dwelling-house, from which a communication can be made without going out into the open air.

Nothing can be more simple than the arrangement of a greenhouse. In winter the plants should be kept rather dry, particularly if the weather be cold and frosty. It will be found frequently necessary to light a fire even in warm weather, to dry off the damp, which is very injurious to plants at that season of the year; and if ever any leaves are seen in a mouldy state they should be instantly picked off and cleaned away, because they would soon infect others, and the whole plant would in a very short time be rendered useless. When a fire is lighted to keep out frost the temperature should not exceed 45° of Fahr., and if there be no frost, and it is put on to dry off the damp, plenty of air must be given, otherwise the moisture will rise, condense upon the glass, and fall again when the house gets cool.

In summer plenty of air should always be given, and if the house have ventilators in the front and back, they may be left open during the night as well as the day. When the house is ventilated by sliding sashes on the roof, it is not advisable to leave any of them open during the night, as the plants are liable to be injured by heavy rains. At this season water must be freely given twice every day, and the plants syringed over-head at least every morning. When the atmosphere is very dry, a few pots of water should be thrown upon the passages, which will render it more moist, lower the temperature, and prevent the plants from suffering from excessive heat. If plants are crowded together they are always unsightly, and can never grow into fine specimens, therefore where the latter are wanted plenty of room is indispensable.

So many persons are at a loss to know how to make a good selection of greenhouse plants, that the following lists will probably be useful:—

1. *Climbers and Twiners.*

Alstromeria acutifolia
. . . hirtella
Billardiera scandens
Cobæa scandens
Hibbertia volubilis
Hoya Pottsii
. . carnosa
Jasminum grandiflorum
Kennedya monophylla
. . nigricans
. . rubicunda
. . prostrata
. . Marryattæ
Lophospermum erubescens
Maurandya Barclayana
Manettia cordifolia
Passiflora cæruleo-racemosa
. . alato cærulea
. . Herberti
. . aurantia
. . chinensis
Pulhbertia gracilis
Rhodochiton volubile
Tecoma capensis
Tropæolum pentaphyllum
. . . tricolor
. . . brachyceras

2. *Shrubby, or ornamental on the stage.*

Acacia pulchella
. . verticillata
. . Brownei
. . longifolia
. . lophantha
. . Cunninghamii
. . decipiens
. . prostrata and others: all the genus is beautiful
Anthocercis albicans
. . . littorea
. . . viscosa
Azalea indica alba
. . . . phœnicea
. . . . Smithii
. . . . purpurea
. . . . coccinea
Banksia serrata
. . prostrata
. . paludosa
. . marginata
. . latifolia
. . grandis
. . foliosa
. . dryandroides
Bauera rubioides
Beaufortia decussata
Begonia insignis
. . discolor
Bossiæa heterophylla
. . linophylla
. . rufa
. . ovata
. . ensata
Brachysema latifolium
. . . undulatum
Buddlea madagascarensis
Calceolaria rugosa
. . . bicolor
. . . angustifolia, and many other splendid hybrids
Callistachys ovata
. . . lanceolata
. . . retusa
Callistemon ellipticum
. . . formosum
. . . semperflorens
Camellia Japonica
. . . . althææflora
. . . . anemoniflora
. . . . Chandleri
. . . . Colvilli
. . . . Donkelaeri
. . . . imbricata
. . . . mutabilis
. . . . princeps
. . . . variabilis, and many other varieties
Camellia reticulata
. . sasanqua
Candollea cuneata
Carmichaelia australis
Chironia linoides
. . frutescens
Chorizema Henchmanni
. . . rhombeum
. . . ovatum
Chrysanthemum sinense
Clethra arborea
Corræa speciosa
. . pulchella
. . alba
Crowea latifolia
. . saligna
Daphne odora
Daviesia mimosoides
. . latifolia
Dillwynia ericæfolia
. . pungens
. . floribunda
Diosma uniflora
. . amœna
. . umbellata
Dracophyllum secundum
. . . gracile
Dryandra calophylla
. . formosa
. . longifolia
Elæocarpus cyaneus
Elichrysum proliferum
Elichrysum sesamoides
Helianthus quinqueflorus
. . . reticulatus
Epacris grandiflora
. . heteronema
. . paludosa
. . nivalis
. . variabilis
. . impressa
. . pulchella
Erica. [ERICA.]
Eriostemon buxifolium
. . cuspidatum
Eutaxia myrtifolia
. . pungens
. . Baxteri
Fuchsia adolphina
. . globosa
. . . . major
. . thymifolia
. . gracilis
. . multiflora
. . Thomsonii
. . . fulgens
Gastrolobium retusum
Gnidia pinifolia
. . simplex
Gomphelobium latifolium
Goodia latifolia
. . pubescens
Grevillea rosmarinifolia
. . ilicifolia
. . acanthifolia
Hibiscus splendens
Hovea Celsi
. . elliptica
. . purpurea
Humea elegans
Illicium floridanum
Indigofera australis
Lambertia formosa
Lantana Sellowii
Lasiopetalum quercifolium
. . . solanaceum
Leschenaultia formosa
Lobelia splendens
. . Tupa
Lychnis Bungeana
Nerium oleander
. . odorum
Oxycoium retusum
. . . cordifolium
Pelargonium, all the varie
Pentstemon Murrayanum

GREENSHANK (*Totanus*), the common name for a well-known wading bird, referred by some ornithologists to the *Godwits*; by others to the *Snipes*. [SCOLOPACIDÆ.]

GREENSTONE. Rocks in which felspar is combined with hornblende, or less commonly augite, the mixture being evident and the ingredients distinct, are usually called Greenstone. In such rocks the felspar is usually white or greenish, and less completely crystallized than in sienite; grains of pyrites frequently occur; the masses have a rude prismatic figure (Corygills, Isle of Arran); and by decay show globular interior structure as in basalt. [BASALT.] If augite and hornblende be in effect the same mineral generated under different circumstances, and hypersthene be analogous, if not identical, it is perhaps probable that geologists may hereafter be disposed to adopt a suggestion of Dr. MacCulloch, and divide sienites, greenstones, and basalts according to the substance united with felspar, which is present in all. We shall then have hornblendic sienite, greenstone and basalt, augitic sienite, greenstone and basalt, hypersthenic sienite, greenstone and basalt, the distinctions between sienite, greenstone, and basalt being chiefly founded on the aggregation of the rock and the character of the felspar. The geological history of greenstone is very similar to that of basalt, and in the same tract of country one quarry may give fine-grained basalt and another distinctly marked greenstone. [ROCKS; BASALT; AUGITE; HORNBLENDE.]

GREENWICH, a market-town, parliamentary borough, and parish in the hundred of Blackheath and county of Kent, on the right bank of the river Thames, five miles east-south-east from London. The chief object of interest is the hospital. It occupies the site of an old palace called Greenwich House, which being in a dilapidated state at the period of the Restoration, was ordered to be taken down and a new one erected in its place. The architect selected for this new work was Webb, son-in-law of Inigo Jones, under whose superintendence the present north-western wing was built, and became the occasional residence of Charles II. No further progress towards completion was however made till the reign of William III., whose wife, it is said, having suggested the plan of founding an asylum for disabled seamen belonging to the royal navy, it was determined, upon the recommendation of Sir Christopher Wren, that the unfinished palace of Greenwich should be enlarged and adapted to that purpose. The property was forthwith vested in the hands of trustees and commissioners appointed. The sum of 2000*l.* per annum was granted by the king; the commissioners themselves contributed nearly 8000*l.*; and Sir Christopher Wren undertook to superintend the work without any pecuniary emolument. The foundation was laid June 3, 1696, and the whole of the superstructure then contemplated was finished within two years, though the hospital was not opened for the reception of pensioners until 1705. In the year of the foundation an act was passed, 7 and 8 William III., cap. 21, by which 6*d.* per month of the wages of all seamen belonging to the royal navy is appropriated to the benefit of the institution. Since that time large sums have been bequeathed by benevolent individuals for the use of the hospital, and the buildings have been successively enlarged and improved. The whole now consists of four quadrangular piles, built principally of Portland stone, and designated by the names of the kings or queens in whose reigns they were erected, viz. King Charles's building on the north-west, Queen Anne's on the north-east, King William's on the south-west, and that of his consort Queen Mary on the south-east. The two latter include the Chapel and Painted Hall. The Chapel was erected from a design of James Stuart, and is highly ornamented. The Hall, a noble room opposite to the Chapel, was painted by Sir James Thornhill, and contains a fine collection of paintings, consisting of naval portraits and sea-fights. The management of the establishment is in the hands of a governor, lieutenant-governor, two chaplains, and numerous other officers. The pensioners, of whom we believe there are at the present time (1838) nearly 3000, receive their maintenance, clothing, and lodging, besides a weekly allowance for pocket money. Originally the hospital was open solely to seamen of the royal navy: but by the 10 Anne, cap. 27, it is enacted that the seamen of the merchant service shall contribute equally with those of the royal navy; and that such of the former as may be wounded in the defence of property belonging to her majesty's subjects, or otherwise disabled while capturing vessels from an enemy, shall also be admitted to the benefits of the institution. The money received from visitors and from other sources is appropriated to the support of a school, wherein upwards of 4000 boys have been educated from the foundation of the establishment to the present time.

The town is partially paved, lighted with gas, and supplied with water from the Kent water-works at Deptford, but the streets are for the most part narrow, and the houses mean and irregular. The park, which comprises near 200 acres, is diversified with lawns, and well planted with elms and chestnut trees. Upon an eminence is situated the royal observatory, commonly called Flamsteed House; and it is from the meridian of this observatory that the longitudes are computed in all British maps.

About a mile to the west of Greenwich is the royal dock-yard of Deptford, established by Henry VIII. in the fourth year of his reign, which comprises a space of about thirty-one acres, wherein the ships of the royal navy were formerly built and repaired. The town communicates with the metropolis by means of a railway on arches of brick, which commences near London Bridge. The population of Greenwich and Deptford in 1831 was 45,929. Both towns are within the diocese of Rochester. The living of St. Mary's, Greenwich, is a vicarage worth 1013*l.* per annum, in the patronage of the crown; and that of St. Nicholas, Deptford, is in the gift of the bishop of the diocese, with an average net income of 557*l.* At Greenwich there are schools for the children of naval non-commissioned officers and sailors, at which about 800 boys and 200 girls are boarded, clothed, fed, and instructed. By the provisions of 2 Will. IV., c. 45, Greenwich was erected into a parliamentary borough, which sends two members to parliament: the limits of the borough include the parishes of Deptford, Woolwich, and a part of Charlton, and contained in 1831 a population of 65,917.

(Hasted's *History of Kent*; Seymour's *Topographical Survey of do.*; Lysons' *Environs of London*; *Parliamentary Papers*, &c.)

GREENWICH OBSERVATORY. The institution of the Royal Observatory at Greenwich originated, it appears (Baily's 'Account of Rev. John Flamsteed, &c.,' p. 37, and 'Historia Cœlestis,' vol. iii., p. 101), in the following circumstance. The extension of navigation in the sixteenth and seventeenth centuries made it a matter of great importance to possess the means of accurately determining the longitude of a ship at sea. It was remarked that this could be effected, provided that the motion of the moon among the stars could be exactly predicted before a ship left England; for then if, at any part of the voyage, the navigators should observe the moon in any situation with regard to the fixed stars, the precise London time could be found from that observed situation. A plan founded on this principle was proposed by a Frenchman, named Le Sieur de St. Pierre, to Charles II. in 1674, who referred it to a commission of official and scientific men, by one of whom (Sir Jonas Moor) the opinion of Flamsteed (already well known as a very learned and enthusiastic astronomer) was taken. Flamsteed however stated that the lunar tables were far too much in error to make this method practicable; and that even the places of the stars in existing catalogues, which must be the foundation for every theory of the motions of the moon or planets, were grievously faulty. Charles II. was much struck with this defect, and measures were taken without delay under his auspices for adopting the cultivation of astronomy as a national object. The Observatory at Greenwich was immediately built, and Flamsteed was appointed Astronomical Observator (the title still retained in official documents) by warrant under the royal sign-manual, with a salary of 100*l.* per annum. The 'finding out the so much desired longitudes of places for the perfecting the art of navigation' was mentioned in this warrant, and also in the warrant for the building, as the reason for instituting the office; and the inscription still existing above the original door of the Observatory declares that it was built for the benefit of astronomy and navigation. No instruments however were supplied by the state: those used by Flamsteed were his own property and partly constructed by himself. Flamsteed's residence at the Observatory commenced in July, 1676; but his best instruments were not in use till 1689. He died in 1719.

The history of this remarkable man, and the tale of his labours, his harsh treatment, and his enthusiasm which carried him through all, have, since the publication of Mr. Baily's

Account, attracted much attention. It is not our intention here to allude further to his personal history; but we may point out the circumstances which give extraordinary value to his observations. His instruments and his methods of observation were much more accurate than any which had been used. The attachment of telescopes to graduated instruments, and the use of a clock to note the time at which stars and planets passed (by their apparent diurnal motion) across the middle of the field of view of the telescope, were a prodigious advance, not only in the accuracy of observations, but also in the simplicity of their plan. Preceding astronomers had been obliged to rely entirely upon measured distances of stars from each other for the determination of their relative places. Flamsteed was at first compelled to use the same method for a few principal stars, but he was afterwards able to avail himself of the clock for the observation of all the smaller stars and the planets, as well as for those important observations of the sun by which the first point of Aries (or the intersection of the sun's apparent path with the celestial equator) is determined. The 'Historia Cœlestis' was not published (in the form approved by himself) till six years after his death: it contains—the observations of every kind, just as they were made; the catalogue, comprising (with some supplied by Mr. Baily from the observations) 3310 stars, whose places were more accurate than any determined in the next 50 years, and whose selection and nomenclature have served as basis to every catalogue since that time; and the places of the sun, moon, and planets, computed from every observation. In regard not only to accuracy of observation, and to detail in publication of the methods of observing, but also to steadiness of system followed through many years and to completeness of calculation of the useful results deduced from the observations, this work may shame any other collection of observations in this or any other country.

But though the publication of the 'Historia Cœlestis' was somewhat delayed, many of the observations (those of the moon in particular) had been doing important service to science. The first edition of Newton's 'Principia' had appeared shortly before Flamsteed had supplied himself with his best instruments; and at Newton's request many of Flamsteed's observations of the moon, reduced as well as was then practicable, were communicated to him to aid in perfecting the theory deduced from the principle of universal gravitation. The time at which these observations were made was, in fact, a most critical one: when the most accurate observations that had been made were needed for the support of the most extensive philosophical theory that man had invented.

On the death of Flamsteed, Dr. Halley (the most learned man, and generally the most active philosopher of the age), then in his sixty-fourth year, was appointed to succeed him. No observations however could be made, as the whole of Flamsteed's instruments were taken away. But in 1721 a transit instrument (similar in its motion to those of the present day, though different in form) was mounted, and in 1725 a very large quadrant. These were constructed at the public expense, and are still preserved at the Royal Observatory. An extension of the buildings was necessary for the new instruments. The introduction of the transit instrument, and the superior accuracy of the quadrant, may be considered as an advance in exactitude upon Flamsteed; but the observations were not made with the same order, and were never prepared for printing. An account of the manuscript books which exist may be seen in the 'Memoirs of the Royal Astronomical Society,' vol. 8, and an account of the instruments in vol. 9. It appears from these that Halley confined his observations principally to the moon, adopting Flamsteed's catalogue of stars as the basis of every determination. In Halley's Tables, published long after his death, there is a comparison of his observed places of the moon with the places deduced from his tables, from 1722 to 1739; but although some sections of the work are expressly devoted to the comparison of the observed places of the planets with his tables, none of these are deduced from his own observations. In fact, with the exception of two or three trifling communications to the Royal Society, the whole of Halley's useful labour as astronomer royal is comprised in the comparisons of the moon's place just noticed. He died in 1742.

Bradley, then known as the ablest astronomer of the time, and already famous for his discovery of the aberration of light, succeeded. His other celebrated discovery, of the nutation of the earth's axis, was not quite completed till he had been a few years at Greenwich. Till the year 1749 he had no other instruments than those used by Halley the observations made with them have not been printed; nor, so far as we are aware, do any results appear to have been deduced from them. They appear from Professor Rigaud's account ('Miscellaneous Works of Bradley,' p. liii., &c.) to be very numerous. But in 1749 a new transit, a second quadrant, and the zenith-sector formerly used by Bradley, were mounted at Greenwich; and from 1750 begins the series of observations which is properly characteristic of this observatory. With small alteration, the same account will apply to all the observations from 1750 to the present time. Regular observations (without a day's intermission, except from the unavoidable hindrances of weather, &c.) of the principal stars, small stars, the sun, moon, and planets, made with the transit-instrument and clock for the determination of right ascension, and with the quadrants (or, in later years, the circles) for the determination of north polar distances, have been the distinguishing employment of this observatory. Observations have occasionally been made with equatoreals or instruments of a similar class, for the determination of the places of comets, &c.; and observations of the times of the eclipses of Jupiter's satellites, the times of occultations of stars by the moon, &c., were sometimes made with detached telescopes, which were incompetent to determine the place of any object in the heavens. But these observations were entirely subordinate to those made with the transit and quadrant; which, from the excellence of the instruments, the care taken in their adjustment, the uniformity in the system of observation, and the extreme regularity with which it has been followed for nearly a century, possess a value to which no other observations have the smallest pretension.

By proper arrangements with regard to the assistants, the interval, elapsing between the termination of the observations made under the auspices of one astronomer royal and the commencement of those of his successor, has been much diminished. Thus Bradley's last observation was on July 16, 1762, and Bliss's first on August 18, 1762; Bliss's last on March 15, 1765, and Maskelyne's first on May 7, 1765; Maskelyne's last on December 31, 1810, and Pond's first on January 4, 1811; Pond's last on September 30, 1835, and the first under the direction of the present astronomer royal, Mr. Airy, on October 1, 1835. This arrangement has contributed much to distinguish the system of observations pursued at Greenwich from that followed at every other observatory.

Another point which in the last century distinguished this observatory from others, and in which in the present century it has been followed by most modern observatories, is the form in which the observations have been printed. Flamsteed set the example of printing the whole of the observations in a tabular form precisely as they were made, thus giving to any future calculator the power of repeating the whole of the computations by which any result was deduced from them. Maskelyne followed this plan; Bradley's observations, in consequence of a litigation as to the right in the manuscripts, were not printed till the present century, when they were arranged in a similar form; and the same principle is still most scrupulously adhered to. For many years past it has been the practice to publish each year's observations as early as possible in the next year.

Besides regular observations of the sun, moon, and planets, Bradley employed himself on the observation of a great number of small stars. Shortly after the publication of his observations, as mentioned above, the celebrated Prussian astronomer Bessel undertook to deduce from them the places of all the stars observed by Bradley, as well as the obliquity of the ecliptic, the position of the first point of Aries, the law and amount of refraction, &c. This was executed in a work entitled 'Fundamenta Astronomiæ,' &c. (in the preparation of which Bessel was assisted by the English Board of Longitude with a grant of money). This work is universally appealed to as containing the most accurate information as to the state of the heavens and the principal facts of astronomy in the middle of the last century. The number of stars in the catalogue deduced from Bradley's observations is 3222; and the determinations of the whole of these possess very great accuracy.

In the short time during which Bliss resided at the Observatory, observations continued nearly on the same plan

as in Bradley's time, the number of observations of small stars being somewhat diminished.

Maskelyne confined his attention, in a great degree, to thirty-six principal stars. "No extended catalogue of stars could be formed from his observations; and in his later years the observation of planets was much neglected. But the sun and moon were observed most regularly; and the exclusive adoption of the principal stars, as above mentioned gives a greater value (other things being equally favourable) to the determinations deduced from his observations than to those obtained from Bradley's. The meridional instruments used by Maskelyne were the same as those used by Bradley from 1750: the quadrant with which observations on the south side of the zenith were made appears to have become sensibly deteriorated by long use, and Maskelyne's observations of stars were not sufficient independently to ascertain its errors: but by comparison of Bradley's and Pond's observations, the true places of stars for Maskelyne's observations have been found, the errors of the quadrant have been ascertained, and the observations of the sun and moon, &c., can now be corrected so as to have the utmost practicable accuracy.

Shortly after Pond's accession, a new transit instrument was mounted, and a few years later a mural circle (both constructed by the celebrated Troughton). After the lapse of a few years more, a second mural circle was mounted (made by Jones). And these are the principal instruments in use at the present day. Pond turned his attention, in a great measure, to the verification of the accuracy of the instruments, and of the methods of observing. For some years no extensive catalogue of stars was observed; but the number of observations of the principal stars was immensely multiplied. The results in general possess an accuracy which before was unknown. A catalogue of more than 1000 stars was however produced, comparable or superior in accuracy to any other of the same extent which had yet been published. The observations of the sun and moon were continued in the same incessant manner, and many observations of the planets were also made.

In the printed observations of Bradley, Bliss, Maskelyne, and Pond (for several years), no results of the observations were given, or at least none of the steps of calculation intermediate between the unreduced observations and the final result. At the instance of the Board of Visitors (appointed under the Royal sign-manual to inspect the Observatory from time to time), these have lately been supplied for the last five or six years of Pond's superintendence of the Observatory.

The present director of the establishment has held his office so short a time, that it is difficult to attach any distinct character to his observations. It may however be stated that the planets are observed with the same regularity as the sun and moon, and that every step of calculation, as far as practicable, is printed in the volume of observations.

Another subject, important to navigation, but slightly connected with astronomy, has by degrees been ingrafted on the regular business of the Observatory. For a long time past it had been remarked that if clocks or watches of great excellence could be carried to sea, the longitude might be determined by them. In 1766, Harrison's plan of an improved watch, or chronometer, was first tried at the Observatory. From that time to the present, there has been little intermission in the trials of chronometers of different constructions. In 1822 chronometer-makers were allowed to send a certain number of chronometers each in competition for prizes, to be adjudged after a year's trial; and above sixty chronometers have sometimes been on trial at once, requiring to be carefully rated every day. A similar competition was repeated every year. This system was abandoned in 1836. The manufacture of chronometers appears to have been greatly improved by these trials. Chronometers having been universally introduced into the Royal Navy, the Royal Observatory is made the depôt for them, and while there they are regularly rated: the management of the repairs is also attached to the business of the Observatory.

From the preceding statement it is hoped that the reader may be able to form a general idea of the nature of the astronomical business to which the Royal Observatory of Greenwich is devoted. It is not to the gazing at planets or nebulæ, or to the watching the appearances of the spots in the sun or the mountains in the moon, with which the dilettante astronomer is so much charmed; it is not to the measures of the relative positions and distances of double stars, or the registering the present state of the nebulous bodies which appear liable to change—measures and registers of great importance, but which possess a charm sufficient to persuade private observers to undertake the observations, and which do not demand extreme nicety of adjustment of the instruments, nor require much calculation afterwards. But it is to the regular observation of the sun, moon, planets, and stars (selected according to a previously arranged system), when they pass the meridian, at whatever hour of the day or night that may happen, and in no other position; observations which require the most vigilant care in regard to the state of the instruments, and which imply such a mass of calculations afterwards, that the observation itself is in comparison a mere trifle. From these are deduced the positions of the various objects, with an accuracy that can be obtained in no other way; and they can then be used as bases to which observations by amateur astronomers, with different instruments, can be referred.

In consequence of the continuity, the regularity, and the general excellence of the Greenwich observations of the sun and moon, they have been almost exclusively used in the construction of the theory and tables of the motions of those bodies. Indeed up to the year 1814 there are no observations, even detached ones, at other observatories, which can be put in competition with the corresponding ones at Greenwich. Since that year, some of the observations of the sun made at Königsberg have been used by the German astronomers. But the Greenwich observations of the moon are to the present time the only ones that can be used for the lunar theories, and probably will always be the only ones. The observations of planets, as far as they go, have also been used in preference to those of other observatories: indeed for the earlier years there are no others to be found.

The business of the Observatory, it will have been remarked, embraces only one branch of astronomy, namely, that depending on meridional observations; excluding that part which has been made so important by the labours of Sir W. Herschel and Sir J. Herschel. There seems to be little doubt that this restriction is advantageous. The part retained is the most laborious, and is also that which best admits of being reduced to a system working well under official superintendence. There is another reason (connected with the magnitude of the instruments used by the two Herschels) which perhaps might not occur to the reader, but which may be illustrated by what has happened at the Observatory. A 20-feet reflecting telescope (Ramage's) was mounted at the Observatory, partly at the desire of Mr. Pond; but we have the best authority for saying that the interruption in the business of the Observatory produced by the parties of visitors who were attracted by this instrument was so great, that Mr. Pond himself was glad to have it dismantled. The increasing population of London and of the neighbourhood of Greenwich has made it necessary now to place the admission of visitors under very strict rules.

From the beginning of Flamsteed's superintendence to the end of Maskelyne's, one assistant only was attached to the Observatory. During Pond's superintendence, the number was gradually increased to six. With this number, observations can be kept up without difficulty at all hours which are necessary; but they are hardly sufficient for completing the mass of calculations which the observations require, and for carrying on the rating, as well as the business of other kinds connected with the government chronometers.

GREGORIAN CALENDAR. [KALENDAR.]

GREGO'RIUS. [CONSTITUTIONS, ROMAN.]

GREGORIUS CORINTHIUS, an archbishop of Corinth in the 12th century, is chiefly known by a work on dialects (Περὶ διαλέκτων), the latest edition of which is by G. H. Schäfer, Leipzig, 1811, 8vo.

GREGORY OF NAZIANZUS, one of the fathers of the church, was born in the early part of the fourth century, at Arianzus, a village near the town of Nazianzus in Cappadocia, of which town his father was bishop. He studied first at Cæsarea in Cappadocia, afterwards at Alexandria, and lastly at Athens, where he became the friend and companion of Basilius, and where he also met Julian, afterwards emperor. At a subsequent period he joined Basilius, who had retired to a solitude in Pontus during the reign of Julian. [BASIL.] When Basilius was made archbishop of

Cæsarea, he appointed his friend bishop of Zasime, a place of which Gregory gives a dismal account, and which he soon after left to join his father, and assist him in the administration of the church of Nazianzus. He there made himself known for his eloquence in the orations which he addressed to his father's flock. These compositions are remarkable for a certain poetical turn of imagery, and for their mild persuasive tone. Above all things he preaches peace and conciliation; peace to the clergy agitated by the spirit of controversy; peace to the people of Nazianzus distracted by sedition; peace to the Imperial governor who had come to chastise the town, and whose wrath he endeavours to disarm by appealing to the God of mercy. In an age of sectarian intolerance he shewed himself tolerant. He had suffered with his brethren from Arian persecution under the reign of Valens; and after that emperor had taken by violence all the churches of Constantinople from the orthodox, or Nicæans, the inhabitants, who had remained attached to that faith, looking about for a man of superior merit and of tried courage to be their bishop, applied to Gregory, who had left Nazianzus after his father's death and had retired into Isauria. Gregory came to Constantinople and took the direction of a private chapel, which he named Anastasia, and whither his eloquence soon attracted a numerous congregation, to the great mortification of the Arians. Theodosius having assumed the reins of government, and triumphed over his enemies, declared himself in favour of the orthodox communion, retook the churches which the Arians had seized, and came himself with soldiers to drive them from Santa Sophia, an act which Gregory says looked like the taking of a citadel by storm. Gregory being now recognised as metropolitan, did not retaliate upon the Arians for their past persecutions, but endeavoured to reclaim them by mildness and persuasion. In the midst of the pomp of the imperial court he retained his former habits of simplicity and frugality. His conduct soon drew upon him the dislike of the courtiers and of the fanatical zealots. Theodosius convoked a council of all the bishops of the East to regulate matters concerning the vacant or disputed sees which had been for many years in possession of the Arians. The council at first acknowledged Gregory as archbishop, but soon after factions arose in the bosom of the assembly, which disputed his title to the see, and stigmatized his charity towards the now persecuted Arians as lukewarmness in the faith. Gregory, averse to strife, offered his resignation, which the emperor readily accepted. Having assembled the people and the fathers of the council to the number of 150, in the church of St. Sophia, he delivered his farewell sermon, which is a fine specimen of pulpit eloquence. After recapitulating the tenour of his past life, his trials, the proofs of attachment he had given to the orthodox faith in the midst of dangers and persecution, he replies to the charge of not having avenged that persecution upon those who were now persecuted in their turn, by observing that to forego the opportunity of revenging ourselves upon a fallen enemy is the greatest of all triumphs. He then pleads guilty to the charge of not keeping up the splendour of his office by a luxurious table and a magnificent retinue, saying that he was not aware that the ministers of the sanctuary were to vie in pomp with the consuls and commanders of armies. After rebuking the ambition and rivalry of his colleagues, which he compares to the factions of the circus, he terminates by taking an affectionate leave of all those around him, and of the places dear to his memory. This valedictory address is a touching specimen of the pathetic style, dignified and unmixed with querulousness. The orator salutes for the last time the splendid temple in which he is speaking, and then turns towards his humble but beloved chapel of Anastasia, to the choirs of virgins and matrons, of widows and orphans, so often gathered there to hear his voice; and he mentions the shorthand writers who used to note down his words. He next bids 'farewell to kings and their palaces, and to the courtiers and servants of kings, faithful, I trust, to your master, but for the most part faithless towards God; farewell to the sovereign city, the friend of Christ, but yet open to correction and repentance; farewell to the Eastern and Western world, for whose sake I have striven, and for whose sake I am now slighted.' He concludes with recommending his flock to the guardian angels of peace, in hopes of hearing from the place of his retirement that it is daily growing in wisdom and virtue. (S. Gregorii Nazianzeni, *Opera*, Billy's edition, *Oratio* 32.)

This oration was delivered in June, A. D. 381, and a few days after Gregory was on his way to his native Cappadocia. Arrived at Cæsarea he delivered an impressive funeral oration to the memory of his friend Basilius, who had died there some time before, in which he recals to mind their juvenile studies at Athens, their long intimacy, and the events of their chequered lives (*Oratio* 20, in Billy's edition). After paying this last tribute to the memory of his friend he withdrew to his native Arianzus, where he spent the latter years of his life, far from the turmoil of courts and councils, busy in the cultivation of his garden and in writing poetry, a favourite occupation with him from his youth. Gregory died A.D. 389. Most of his poems are religious meditations. Occasionally the poet attempts to dive into the mysterious destiny of man, and sometimes appears lost in uncertainty and doubt as to the object of human existence, but he recovers himself to do homage to the Almighty wisdom whose secrets will become revealed in another sphere. The adept in the philosophy of antient Greece is here seen striving with the submissive Christian convert. St. Jerome and Suidas say that Gregory wrote no less than 30,000 lines of poetry. Part of his poems were published in the edition of his works by the Abbé de Billy, Paris, 1609-11, which contains also his orations and epistles; twenty more poems, under the title of 'Carmina Cygnea,' were afterwards published by J. Tollius in his 'Insignia Itinerarii Italici,' 4to., Utrecht, 1696, and Muratori discovered, and published in his 'Anecdota Græca,' Padua, 1709, a number of Gregory's epigrams. Of his orations some few turn upon dogmas, especially on that of the Trinity, but most of them are upon morality. He is a soberer writer than his successor Chrysostom, and has more of the calm impressive eloquence of conviction. He and his friend Basilius brought the oratorical arts of antient Greece into the service of Christian preaching, and one of Gregory's greatest complaints against Julian is that that emperor had forbidden Christians the study of Greek literature. In his two orations against Julian, he somewhat departs from his usual style, and assumed that of a powerful invective in reply to the panegyrics of Libanius, Eunapius, and other admirers of that emperor. Gregory of Nazianzus has been styled the 'Theologian of the Eastern Church:' he might with as much truth be styled its most poetical writer. (Suidas *v.* Gregorius; Gregorii *Opera; Drama*, p. 136. There are several lives of Gregory; one of which is prefixed to the handsome edition of his 'Orations' by the Benedictines of St. Maur, 2 vols. fol., Paris, 1778. The Abbé de Bellegarde published a French translation of Gregory's 'Orations,' 2 vols. 8vo., Paris, 1693.)

GREGORY OF NYSSA. [Fathers of the Church.]

GREGORY THAUMATURGUS. [Fathers of the Church.]

GREGORY OF TOURS, born in 544, of a family of Auvergne, was nephew to Gallus, bishop of Clermont, who took care of his education. He was made bishop of Tours in 573, attended several councils, and distinguished himself by his courage and firmness in denouncing the guilty conduct of Chilperic and Fredegonda, who reigned over France. His boldness exposed him to a sort of persecution, and he retired to Rome, where he died in the year 595. He wrote in Latin a history of France from the first establishment of Christianity till the year of his death. Gregory is the father of the French historians, and the only one who has left us an account of the early Merovingian kings. He is evidently sincere, but very credulous; and he is often ungrammatical and rude in his style and expressions, and he neglects dates. He spares not his enemies: Chilperic he calls the Nero of his age, and speaks in no milder terms of his queen Fredegonda. The best edition of Gregory's history is that of Paris, 1699, fol. He also wrote a legendary account of the virtues and miracles of saints, and other works of a similar nature, a notice of which is given in Rivet's 'Histoire Littéraire de la France,' vol. iii.

GREGORY I., styled the Great, born about A. D. 550, of a noble Roman family, distinguished himself for his learning, and was made prefect of that city in 573. His ascetic turn of mind made him give up that office and retire to a monastery, from which he was recalled by Pope Pelagius II., who sent him on an embassy to Constantinople to request assistance against the Longobards. On his return to Rome, after the death of Pelagius, in 590, the clergy and people elected him as his successor. Gregory earnestly wished to decline that dignity; he wrote to the emperor Mauric entreating him not to confirm his election, and he even

concealed himself; but all was in vain, and he was obliged at last to fill the pontifical chair. He showed great zeal for the reformation of the abuses and corruptions which had crept into the church, as well as for the propagation of Christianity. He assisted Theodolinda, queen of the Longobards, in converting that people to the Catholic faith. He likewise sent missionaries into Sardinia, and zealously supported the mission to England, where the king of Kent and many of the Anglo-Saxons had embraced Christianity. It was previous to his exaltation to the pontifical chair, that seeing one day in the slave-market at Rome some Anglo-Saxon children exposed for sale, and being struck by their comely appearance, he is said to have exclaimed: 'They would be indeed not Angli but Angels, if they were Christians,' and from that time he engaged his predecessor Pelagius to send missionaries to England. John the Abstinent, archbishop of Constantinople, having assumed the title of Œcumenic, or Universal Patriarch, Gregory wrote to him in 595 to induce him to relinquish a title which gave offence to his brethren. 'You know that the council of Chalcedon,' says he in his letter, 'offered the title of Œcumenic to the bishop of Rome, but that all my predecessors have refused an assumption full of pride and inconsistent with the antient discipline.' Gregory himself adopted the denomination of 'Servus Servorum Domini,' ('servant of the servants of the Lord,') meaning the bishops, an appellation which the popes have retained, even since their assumption of universal supremacy. Gregory exercised the jurisdiction of primate of Italy, and gave advice to the other bishops, but not commands. He lived in the most frugal and simple style, although he had at his disposal the large wealth of the Roman see, which he distributed to the poor. He was averse from persecuting heretics and Jews: he considered mildness and persuasion as the only means to bring them to Christianity.

He has been reproached with having written to the usurper Phocas, who had murdered the emperor Mauritius and had seized on his crown, a letter in a flattering strain, apparently with the view of securing the protection of the Eastern Empire in favour of Rome, then threatened by the Longobards. Another charge against Gregory is, that he destroyed some classical MSS., the remains of the Imperial library at Rome; but this charge was made many centuries after, and does not seem to rest upon clear evidence. Gregory manifested however an aversion to the works of the Heathen writers, especially those which treated of mythology, and forbade their perusal. He wrote numerous works, which have been collected and published by the Benedictines of St. Maur, 4 vols. fol., Paris, 1707. The most important are:—1. 'Moralium, libri xxxiv.'; 2. 'De Cura Sacerdotali,' being a pastoral instruction on the duties of the parochial clergy; 3. his 'Letters,' in 12 books, which contain some interesting particulars on contemporary history; 4. his 'Dialogues,' which contain many accounts of miracles, a matter on which Gregory shows himself rather credulous. Gregory died at Rome in 604, and was succeeded by Sabinianus of Volaterra.

GREGORY II., a native of Rome, succeeded Constantine in the see of Rome, A.D. 715, and was involved in disputes first with Luitprand, king of the Longobards, against whom he implored the assistance of Charles Martel, and afterwards with Leo Isaurus, on the subject of image-worship, which that emperor had proscribed. He convoked two councils, one against the Iconoclasts, and another to forbid marriage to persons who had once entered the monastic rule. It was under his pontificate that Boniface went to preach Christianity in Germany. Gregory died in 731.

GREGORY III., a native of Syria, succeeded the preceding, and continued the controversy with Leo Isaurus concerning image-worship. He found himself likewise involved in a dispute with the Longobards, and died in 741. He was succeeded by Zacharias.

GREGORY IV., a native of Rome, succeeded Valentinus, A.D. 827. The coast near Rome being exposed to incursions from the Saracens of Sicily, Gregory undertook to build a new town near Ostia, to which he gave the name of Gregoriopolis. Pending the quarrel of Louis le Debonnaire and his revolted sons, Gregory proceeded to France to conciliate matters; but he drew upon himself the dissatisfaction of both parties, and even of the French bishops. He died at Rome, in 844. He was succeeded by Sergius II.

GREGORY V., a German of the name of Bruno, and a relative of Otho III., was elected pope through the influence of that emperor, in 997, after the death of John XV., whom some style XVI. Gregory crowned Otho at Rome as emperor and king of Italy. After Otho's departure, the patrician Crescentius, who had assumed the title of consul, excited the people against the new pope, and drove him out of the city. Crescentius seems to have aspired to govern Rome under a nominal allegiance to the Eastern emperors. He procured the election of an anti-pope in the person of John, bishop of Piacenza, who entered into his views; but in the following year Otho and Gregory returned with an army to Rome, imprisoned John, who was cruelly mutilated, and beheaded Crescentius, with twelve of his partisans. In the year after, February, 999, Gregory died, and was succeeded by Sylvester II.

GREGORY VI., a native of Rome, succeeded Benedict IX. after his abdication, A.D. 1044. [BENEDICT IX.] He was disliked by the Romans, who, being accustomed to the licentiousness and anarchy which had prevailed under the disgraceful pontificate of Benedict, could ill bear the attempts of the new pope to enforce order. The emperor Henry III. assembled a council at Sutri, which deposed all the three popes, Benedict, Sylvester III., and Gregory, A.D. 1046, and chose Clement II. Gregory is said to have willingly resigned his claims, and to have retired to a monastery, where he ended his days.

GREGORY VII., Hildebrand of Soano, in Tuscany, was of low parentage, and became a monk in the convent of Cluny. Having acquired a reputation for theological and canonical learning, and for strict regularity of conduct, he afterwards went to Rome with Bruno, bishop of Toul, a relative of the emperor Henry III., who was elected pope in 1049, under the name of Leo IX., chiefly through Hildebrand's influence. From that time the monk Hildebrand became the mainspring of the Roman hierarchy, and the intimate councillor of Leo, and his successors, Victor II., Stephen IX., Nicholas II., and Alexander II. He was sent to Germany on a mission to the Imperial court by Stephen IX., and on his return he defeated the faction which had raised to the papal throne Benedict X., and secured the election of Nicholas II. After the death of Alexander II., in 1073, Hildebrand was unanimously elected his successor by the clergy and people of Rome, but he did not assume his title until he had received the approbation of the emperor Henry IV., to whom he despatched messengers for the purpose. The emperor, pleased with this act of deference, readily confirmed his election, and Hildebrand assumed the name of Gregory VII. The great object of Gregory's ambition was, as he expressed himself in a letter to Hughes, abbot of Cluny, to effect a total reform of the church, which certainly stood in great need of it. Simony prevailed throughout the Christian world, and sees were openly sold or given by sovereigns to their favorites. The bishops, raised by such means, caring little for their duties or their flocks, but much for their worldly advantage and pleasures, sold the benefices at their disposal. Gregory determined to remove the evil by taking away from the secular princes the right which they assumed of disposing of the sees within their dominions. The emperor Henry IV., licentious, ambitious, and at war with his revolted vassals, and therefore continually in want of money, was one of the most culpable in respect of simony. He disposed of sees and benefices in favor of vicious or incapable men, and the bishops of Germany readily entered into his views of making the church a sort of feudal dependant on the Imperial will. Gregory began by admonishing Henry: he sent legates to Germany, but to little purpose. His next step was to assemble a council at Rome, A.D. 1074, which anathematized persons guilty of simony, and ordered the deposition of those priests who lived in concubinage, under which name were also included those who lived in a state of matrimony, and it was decreed also that no one should be admitted to holy orders unless he made a vow of celibacy. This last regulation created a great uproar, especially at Milan, where the custom of priests being married was still prevalent, as in the Eastern church. Gregory summoned another council at Rome, A.D. 1075, in which, for the first time, kings and other lay princes were forbidden, under pain of excommunication, from giving the investiture of sees and abbeys by conferring the ring and the crosier. This was the beginning of the quarrel about the investiture which distracted Europe for many years after, and which may here require some explanation. In the

early ages of the Christian church, it would appear that the body of the clergy, or presbyters, of a town or district, together with the municipal council, or notables, elected their bishop, or chief pastor, and the Christian emperors did not interfere with the choice, except in the case of the great patriarchal sees, such as Rome and Constantinople, the candidate to which, after being elected by the clergy and people, was required to wait for the Imperial confirmation. The Gothic kings of Italy followed the same system, as well as the exarchs of Ravenna after them, in the name of the Byzantine emperors. At Rome, and probably in the rest of Italy also, the laity participated in the election of their bishops till the tenth century; in the East they appear to have been excluded from it sooner. Charlemagne is said by some to have introduced the custom of putting the ring and crosier into the hands of new-elected bishops, while he required from them the oath of fealty to himself. There seems no doubt at least that the custom was prevalent under his successors of the Carlovingian dynasty. The reason of this was, that the churches having been richly endowed by various sovereigns with lands and other temporalities, the incumbents were considered in the light of feudal tenants. By thus keeping at their own disposal the temporalities of the sees, the sovereigns came gradually to appoint the bishops, either by direct nomination, or by recommending a candidate to the electors. Gregory making no distinction between spiritualities and temporalities, considered the investiture as a spiritual act, insisting that the crosier was emblematic of the spiritual authority of bishops over their flocks, and the ring was the symbol of their mystical marriage with the church; although, Sarpi observes, in his 'Treatise upon Benefices,' there was another ceremony, namely, the consecration of the bishop elect by imposition of hands by the metropolitan, which was the real spiritual investiture. But Gregory's object was to take away from laymen all ecclesiastical patronage, and to make the church, with all its temporalities, independent of the state. He would not admit of any symbol of allegiance to the state, and he contended that the estates of sees had become inseparably connected with the spiritual office, and could no longer be distinguished; and yet he himself had waited for the confirmation of the emperor before he was consecrated.

The emperor Henry IV. paid no regard to Gregory's councils and their decrees, and he continued to nominate not only to German but also Italian bishoprics. Among others he appointed a certain Tedaldo archbishop of Milan, in opposition to Azzo, a mere youth who had been consecrated by Gregory's legate. But the quarrel of the investiture, which had opened the breach between the pope and the emperor, was lost sight of in the more extraordinary discussions which followed between them. Gregory had been for some time tampering with Henry's disaffected vassals of Saxony, Thuringia, and other countries, and he now publicly summoned the emperor to Rome to vindicate himself from the charges preferred by his subjects against him. This was a further stretch of that temporal supremacy over kings and principalities which the see of Rome had already begun to assume. Henry, indignant at this assumption of power, assembled a diet of the empire at Worms, at which many bishops and abbots were present, and which upon various charges preferred against Gregory deposed him and despatched a messenger to Rome to signify this decision to the Roman clergy, requesting them to send a mission to the emperor for a new pope. Upon this, Gregory, in a council assembled at the Lateran Palace, A. D. 1076, solemnly excommunicated Henry, and in the name of St. Peter, prince of the apostles, declared him *ipso facto* deposed from the thrones of Germany and Italy, and his subjects released from their oath of allegiance. Gregory, observes Platina, in his 'Lives of the Popes,' was the first who assumed the right of deposing the emperors, whose vassals he and his predecessors had been considered till then, and who had even exercised the power of deposing several popes for illegal election or abuse of their authority. This bold act of Gregory produced for a time the effect which he had calculated upon. Most of Henry's subjects, already ripe for rebellion, readily availed themselves of the papal sanction, and a diet was assembled to elect a new emperor. Henry however obtained a delay, and the matter being referred to the pope, he set off for Italy in the winter of 1077, and passing the Alps of Susa, met Gregory at the castle of Canossa, near Reggio in Lombardy, which belonged to the Countess Mathilda, a great friend and supporter of the pope. Gregory would not see Henry at first, but insisted upon his laying aside all the insignia of royalty and appearing in the garb of a penitent, in a coarse woollen garment and barefooted. In this plight, Henry remained for three days from morning till sunset in an outer court of the castle, in very severe weather. On the fourth day he was admitted into Gregory's presence, and on confessing his errors received absolution, but was not restored to his kingdom; the pope referring him to the general diet. Henry soon after resumed the insignia of royalty, and being supported by his Lombard vassals, and indignant at the humiliating scene of Canossa, recrossed the Alps, fought several battles in Germany, and at last defeated and mortally wounded Rudolf of Suabia, who had been elected emperor in his stead, and was supported by Gregory. Having now retrieved his affairs in Germany, he marched with an army into Italy in 1081, to avenge himself on the pope, whom he had again deposed in another diet, having appointed Guibert, archbishop of Ravenna, as his successor, under the name of Clement III. Gregory had meantime drawn to his party by timely concessions Robert Guiscard, the Norman conqueror of Apulia and Sicily, who however could not prevent Henry from advancing to the walls of Rome. But the city was well defended, and the summer heats obliged Henry to retrace his steps towards North Italy, where his soldiers ravaged the territories of the Countess Mathilda. He repeated the attempt against Rome in 1082 and again in 1083, but without success. It was finally agreed that a general council should decide the questions between the emperor and the pope. The council assembled at Rome in 1083, and Gregory did not again excommunicate the emperor, but negotiated with him without coming to any definitive result. In the following year, 1084, Henry was invited by some ambassadors from the Roman people, who were dissatisfied with the pope, to enter the city, which he did on the 21st of March, and immediately took possession of the Lateran, the bridges, and other important positions. Gregory escaped into the Castle of St. Angelo, and the antipope Guibert was publicly consecrated on Palm Sunday, by several bishops. On the following Easter Sunday Henry IV. was crowned by him as emperor in St. Peter's Church. After the ceremony Henry ascended the capitol and was publicly proclaimed, and acknowledged by the Romans with acclamations. Hearing however that Robert Guiscard was approaching to Rome with troops, he left the city and withdrew towards Tuscany. Robert came soon after with his Norman and Saracen soldiers, who under the pretence of delivering Gregory, who was still shut up in the Castle St. Angelo, plundered Rome and committed all kinds of atrocities. Gregory having come out of his stronghold, assembled another council, in which, for the fourth time, he excommunicated Henry and the antipope Guibert. When Robert left the city to return to his own dominions, the pope, not thinking himself safe in Rome, withdrew with him to Salerno, where, after consecrating a magnificent church built by Robert, he died in the following year, 1085. His last words were, 'I have loved justice and hated iniquity, and therefore I die in exile.'

The character of Gregory VII. has not been justly estimated by the generality of historians. He was sincere in his wishes for ecclesiastical reform, and he was himself pure and disinterested; but in pursuing his favourite and, to a certain extent, legitimate object, he was led astray by the ambition of exalting his see over all the dignities and powers of the earth, spiritual as well as temporal. Not content with making, as far as in him lay, the Church independent of the empire, and at the same time establishing the control of the Papal authority over the princes of the earth, objects which he left to be completed by his successors [INNOCENT III.], Gregory destroyed the independence of the various national churches. By a constitution of his predecessor Alexander II., which he dictated, and which he afterwards confirmed, it was enacted for the first time that no bishop elect should exercise his functions until he had received his confirmation from the pope. The Roman see had already in the ninth century subverted the authority of the metropolitans, under pretence of affording protection to the bishops; but now it assumed the right of citing the bishops, without distinction, before its tribunal at Rome to receive its dictates, and Gregory obliged the metropolitans to attend in person to receive the pallium. The quarrel of Anselm, archbishop of Canterbury, with William Rufus was owing to that monarch not choosing to let him go to Rome, whither he had been summoned. The practice of

neswald, the chief town of a circle of the same name, which is the easternmost part of the head circle of Stralsund in Pomerania. It is situated about three miles from the shores of the Baltic, on the southern borders of a narrow arm of the sea, called the Rickgraben, in 54° 4′ N. lat. and 13° 35′ E. long. It was founded between the years 1231 and 1235, by the monks of the neighbouring monastery of Eldena, and was at one time strongly fortified; but the ramparts have been converted into plantations and walks, and none of the defences now remain except the old wall round the town, through which there are three gates. The streets are broad and straight; there are one suburb, three churches, an orphan asylum, an hospital, and several benevolent institutions. The professors of Rostock having sought an asylum here in 1456, Wratislaw, duke of Pomerania, was induced in that year to found the university of Greifswalde, the buildings of which are the principal embellishment of the town. Independently of lecture-rooms, they contain a handsome library of upwards of 32,000 volumes, cabinets of experimental philosophy, models, natural history, and zoology, and an anatomical theatre. Behind the buildings is a small botanic-garden. The number of professors is 30, and the students vary from 200 to 250; in 1815, there were 55 only. Greifswalde has about 950 houses and 9400 inhabitants; in 1817, 7452. It is the seat of a court of appeal and a consistory, and possesses some salt-works, as well as manufactories of oil, needles, leather, tobacco, brandy, candles and soap, &c.

GREITZ. [Reuss.]

GRENADA, one of the Lesser Antilles, lies between 11° 58′ and 12° 20′ N. lat., and between 61° 20′ and 61° 35′ W. long.: its greatest length from north to south is twenty-five miles, and its greatest breadth twelve. This island was discovered by Columbus on his third voyage in 1498, at which time it was inhabited by Caribs. It was not until a century and a half from the time of the first discovery that any attempt was made for its colonization. In the year 1650, Du Parquet, governor of the island of Martinique, having collected a body of 200 adventurers, landed on Grenada, and was received in a friendly manner by the natives, who having obtained from their visitors some cutlery and ornaments of little value permitted the adventurers to form a settlement. A fort was soon built for the protection of the colonists, who in a very few months after their first landing commenced a war of extermination against the Caribs, every one of whom that fell into the hands of the French was forthwith murdered. It appears that the conquest of this island was considered in the light of a private adventure for Du Parquet, who subsequently sold it to Count Cerillac for 30,000 crowns. It was some time before much progress was made in the settlement of the colony, and in 1700 there were only three sugar plantations, and some indigo-works; the entire population consisting of 251 whites and 520 negroes. Cultivation afterwards proceeded more rapidly, and in 1762, when the island was surrendered on capitulation to the English, the annual produce of sugar is said to have been 165,000 cwt. By the definitive treaty of Paris signed in February, 1763, Grenada was finally ceded to Great Britain, and a legislative council and assembly were granted to the inhabitants. An attempt was soon after made on the part of the crown to impose for its benefit an export duty of 4½ per cent. on the produce of the island, but this being resisted by the colonists was, after considerable litigation, decided against the crown, in the Court of King's Bench, in 1774, by Lord Chief-Justice Mansfield. In 1779 the island was taken by the French under Count D'Estaing, but was restored at the general peace in 1783, and since that time has remained in possession of the English.

The island is traversed throughout its whole length from north to south by an irregular range of mountains rising in some places to the height of more than 3000 feet. Mount St. Catherine, near the centre of the island, is 3200 feet high. Hills of less elevation branch off from the principal range in a lateral direction, forming a succession of rich and extensive valleys, which as they approach the shore open into level alluvial plains. On the south-east or windward side of the island there is a considerable extent of low swampy ground, the neighbourhood of which is very unhealthy, particularly in autumn. Several small rivers rise in the high lands. The most considerable are, Great Bacolet, Antoine, Duguisne, Saint John's, and Beau-séjour. Several hot chalybeate and sulphurous springs are met with in different parts. In the centre of the island, and 1700 feet above the sea, is a circular lake 2½ miles in circumference and 14 feet deep. On the east coast, about half a mile from the sea, is another lake, 60 acres in extent and about 50 feet deep, the surface being only 43 feet above the sea, with which it has no communication: it is believed to be the crater of an extinct volcano.

The soil consists principally of a rich black or reddish coloured mould. The fall of rain is about 65 inches in the year. In the low ground the heat is often oppressive; but on the hills the atmosphere is cool and pleasant. From a register of the temperature kept in the low grounds for five years, it appears that the maximum heat was 89° Fahr., the minimum 77°, and the medium consequently 83°. The hottest season is from June to October, during which the thermometer ranges from 78° to 88½°.

The island cannot be considered healthy. In the fifteen years from 1817 to 1831 the annual deaths among the slave population averaged 1 in 30, being worse in this respect than every other West India colony, with the exception of Tobago, where the mortality averaged 1 in 24. The average mortality of the same class throughout the colonies was 1 in 36. In 1794 the yellow fever raged with dreadful violence, people of all classes and of every age being carried off by it. In 1816, from November till the following February, the fever raged so violently that 1 in 10 of the white troops fell under it.

The town of St. George is situated on the south-west side of the island, at the foot of an amphitheatre of hills encircling an extensive bay. It is a well-built town, and contained in 1834 a population of 3156 persons, of whom 210 were whites, 1526 were free coloured persons, and 1420 were apprentices. The whole population of the island was in that year 25,422, viz.:—

	Males.	Females.	Total.
Whites . . .	490	171	661
Free coloured persons .	1,675	2,012	3,687
Apprenticed labourers .	10,648	10,426	21,074
Total	12,813	12,609	25,422

The island then contained 516 horses, 8869 head of cattle, and 2706 mules and asses. The exportable produce was—

Sugar . .	22,738,643 lbs.
Rum . .	818,619 gallons.
Molasses . .	394,533 „
Cotton . .	154,834 lbs.
Cocoa . .	410,037 „
Coffee . .	21,605 „

The cocoa of Grenada is the best that is grown in any English colony.

The value of imports in 1834, consisting chiefly of British manufactured goods, was 126,776*l*., and the exports amounted to 267,998*l*., of which sum 202,671*l*. consisted of the value of sugar shipped to Great Britain.

GRENADE, frequently called hand-grenade, is a shell or hollow ball of iron, 2½ inches in diameter, which, being charged with powder and provided with a fuze, is thrown from the parapets into the ditch and covered-way when occupied by the besiegers; or from the covered-way into the trenches, when the latter approach within 25 yards of the crest of the glacis.

As soon as the composition in the fuze is consumed, the fire communicates with the powder, and the ball is burst in fragments.

Grenades were first used in 1594.

GRENOBLE, a city of France, capital of the department of Isère. It is situated on the banks of the river Isère (which flows through the town, dividing it into two unequal portions), just above the confluence of the Drac and the Isère, 296 miles in a straight line south-south-east of Paris, or 352 miles by the road through Auxerre and Lyon, in 45° 11′ N. lat. and 5° 43′ E. long.

Grenoble is designated in the 'Theodosian Table' and in the 'Notitia Imperii' by the name of Cularo. Inscriptions which have been dug up speak of the fortifications and the edifices within the town, which were erected by the Emperors Diocletian and Maximian, from whose assumed designations of Jovius and Herculius two of the gates were named Porta Jovia and Porta Herculea. In the fourth century the name Gratianopolis was given to the town, in compliment to the Emperor Gratian; and this new name gradually superseded the old one, Cularo, and was

the origin of the modern name Grenoble. Grenoble was formerly the capital of Dauphiné.

That part of the town which is on the north bank of the Isere, called the quarter of St. Laurent, or La Perrière, consists principally of one or two long streets, extending from the river to an eminence which commands the town on the north. This part of Grenoble is surrounded by an antient wall, the circuit of which includes the summit of the above-mentioned eminence. This summit was once occupied by a Bastile, now in ruins. The quarter of the town on the south bank of the river is called Bonne; the two quarters are united by two bridges, one of wood and the other of stone. The quarter of Bonne is defended by a wall and bastions; but although ranking as a fortress it is not considered to be a place of great strength. It is of considerable size, and the streets are well laid out; but the houses are not good. Among the principal buildings are the office of the prefect of the department, occupied before the Revolution by the intendant of the generalité of Grenoble; the Palais de Justice (court of justice), an antient building of Gothic architecture; the Hotel de Ville (town-hall) once the residence of the constable Lesdiguières; and the building occupied by the College, or High School, by the public library of nearly 60,000 volumes and some valuable manuscripts, and by the museums of Natural History, the Fine Arts, and Antiquities. This building is adorned by the statues of the chevalier Bayard, the mechanician Vancanson, and the philosophers Condillac and Mably, all four natives of Grenoble. There are also an arsenal, four public baths, the cathedral (a Gothic building), an episcopal palace, a handsome hospital, a theatre, a public garden, and several public walks.

The population of Grenoble in 1831 was 24,268 for the town, or 24,888 for the whole commune. The chief manufactures of the town are of liqueurs, of chamois and other leather, and especially of gloves. The trade of the place is much promoted by the navigation of the Isère, which, in spite of the rapidity of the stream, is carried up as high as Montmeillan, in Savoy, 25 miles above Grenoble; the chief articles of trade are leather, gloves, hemp, wrought-iron, marble (which is quarried in the neighbourhood and worked in the town), fir timber for masts, and walnut-tree wood for furniture. There are four yearly fairs for linens, woollens, hardwares, and cattle.

Grenoble is the seat of a bishopric; of a Cour Royale, whose jurisdiction extends over the departments of Isère, Drôme, and Hautes Alpes; and of an Académie Universitaire, comprehending two faculties, sciences and law. There are a high school, a school of medicine, a drawing-school, a school for the artillery, two seminaries for the priesthood, museums, a botanic garden, at which courses of instruction are delivered, and other institutions. Beside the cathedral and four parish churches, there are a Protestant church, four nunneries, the general hospital mentioned above, and a foundling hospital. Grenoble is the head-quarters of the VII. military division, which includes the departments of Isère, Drôme, and Hautes Alpes. The arrondissement of Grenoble comprehends twenty cantons and two hundred and nineteen communes. the population in 1831 was 203,346.

The diocese of Grenoble is supposed to have been established in the latter part of the fourth century: the bishops were suffragans of the archbishop of Vienne, and their dioceses comprehended the districts of Grésivaudan, Royanès, and Champsaur. The diocese now comprehends the department of Isère, and the bishops are suffragans of the archbishops of Lyon and Vienne.

GRE'S. This French equivalent of the English word grit, or sandstone, includes several rocks, which may be thus noticed:—

Grès de Fontainebleau	A tertiary rock.
Grès de Vienne / Grès des Carpathes	Equivalent of the greensands.
Grès de Luxembourg	Between the lias and the variegated marls.
Grès bigarré	Equivalent of the bunter sandstein (German), and new red sandstone (English).
Grès Vosgien	A local red grit rock on the flanks of the Vosges mountains.
Grès rouge	The sandstone below the magnesian limestone (termed rother sandstein in some parts of Germany, also called rothe todte liegende.)
Grès houillier	Grits of the coal formation.

GRESHAM, SIR THOMAS, was descended of an antient family of Norfolk. His father, Richard Gresham, a younger son, was bred to trade, and was a member of the Mercers' Company. In due time he became a leading man in the city, was agent to Henry VIII. for negotiating loans, &c., with foreign merchants, and obtained the honours of knighthood and the mayoralty. He died February 20, 1548. Thomas Gresham, his second son, was born in London in 1519, and studied at Gonville (now commonly called Caius) College, Cambridge. But Sir Richard, while giving his son the benefit of a liberal education, intended him to tread in his own steps, and bound him apprentice to his brother Sir John Gresham, who also belonged to the Mercers' Company, and also had acquired a large fortune by trade. Thomas Gresham took out his freedom in 1543. In 1551 he was employed, as his father had been, in negotiating foreign loans by Edward VI.; and he did good service in this capacity. When money became due it seldom was convenient to pay it; and an extension of the time was commonly purchased on terms ruinously high, 10 per cent., for instance, clogged with the further condition of purchasing certain jewels, or other wares, at the price of the vendor. By Gresham's skill and assiduity the outstanding debts were paid off, and an enormous saving made, the particulars of which, as stated in his own memorial, will be found in Ward's 'Lives of the Gresham Professors,' p. 8. By his advice the experiment of raising money at home rather than from foreigners was first tried by Elizabeth in 1569, and followed with great advantage both to the crown and the nation. He was employed in the same capacity of agent by Mary and Elizabeth, received knighthood from the latter in 1559, and was often consulted by her in political and commercial affairs. His favour, his office, and his princely munificence, combined probably to procure him the title of the Royal Merchant. He built a noble house on the west side of Bishopgate-street (where the Excise-Office now stands), where he lived in splendour, and was occasionally commissioned by the queen to receive and entertain foreign visitors of high rank. Increasing in wealth, he bought estates in many parts of England; among others Osterley, near Brentford, now in possession of the Earl of Jersey, which next to London was his chief place of abode. He died suddenly November 21, 1579, leaving no children, except one natural daughter.

In the foundation of the Royal Exchange Sir Thomas Gresham has left a lasting memorial of his wealth and generosity. Previously the merchants were used to meet, without shelter, in Lombard-street. Sir Richard Gresham contemplated the scheme of building an exchange, or covered walk, such as he had seen abroad, but did not effect it. Resuming the design, Sir Thomas offered to erect a suitable building if the citizens would provide a plot of ground. The site north of Cornhill was accordingly purchased in 1566, for more than 3500*l.* The date of completion is not clearly known; but January 23rd, 1570, the queen dined at Gresham's house, visited the new building, and caused it to be proclaimed by sound of trumpet the 'Royal Exchange.' This building was destroyed in the great fire of 1666. A view of it may be seen in Ward's 'Lives.' It was similar in its main features to its successor, consisting of a quadrangular arcade surrounding an open court, with galleries above containing shops, &c. From the rents of these Gresham derived a yearly income of 750*l.*, besides fines. (Ward, *Appendix* iv.)

One moiety of his interest herein Gresham bequeathed to the corporation of London, and the other to the Mercers' Company, on condition of their making certain annual payments, amounting to 603*l.* 6*s.* 8*d.* After the fire the Exchange was rebuilt on a larger scale; and it is a striking instance of the rise of prices, that the *additional* ground required cost 7017*l.* 11*s.* The new building cost 58,962*l.* This, with some alterations, of which the chief was the rebuilding of the clock-tower in 1821, stood till the beginning of this year, when it was again destroyed by an accident, January 10, 1838. It is to be hoped that it will again be rebuilt on a still larger and more splendid scale, calculated to meet the increased and increasing demands of the metropolitan trade.

GRESHAM COLLEGE. In furtherance of a long che-

rished design, Sir T. Gresham vested his house in Bishopgate-street in the same parties as the Royal Exchange, in trust to preserve it for the residence of seven skilful teachers: four, of the sciences of divinity, astronomy, music, and geometry, to be appointed by the corporation of the city; three, of law, physic, and rhetoric, to be appointed by the Mercers' Company. A stipend of 50*l.* was made payable to each out of the rents of the Exchange. Apartments were to be assigned 'for them and every of them, there to inhabit, study, and daylie read the severall lectures:' and they were required to be unmarried. Lady Gresham (whose life interest was reserved) surviving until November, 1596, the first professors were appointed in the following year. It seems doubtful, by the words of the will, whether the testator did not intend lectures to be read throughout the year; but, according to the original directions of the trustees, the times of lecturing were appointed so as nearly to coincide with the law terms. For some time the lectures are said to have been well attended. In 1706 complaints were made that the founder's wishes were disregarded, and that the professors had become negligent: and fresh orders were issued by the trustees, the execution of which was partially resisted, and with success, by the professors. In the seventeenth century we find eminent names among them, such as Gunter, Wren, Briggs, Greaves, Barrow, Hooke, Bull, Mus. Doc., Sir William Petty. But in the eighteenth few or no distinguished men appear. In 1768 an end was put to the collegiate character of the institution. The college was sold to government for the site of a new Excise-office, the salaries of the lecturers raised to 100*l.* as compensation for the loss of their lodgings, and the restrictions as to marriage were taken off by act of parliament. Since that time the lectures have been read at the Royal Exchange. During many years they fell into disrepute and neglect. Public attention has of late been drawn towards them; and it is to be hoped that the increased and increasing zeal of the present officers will remove the slur which common report has long cast upon this establishment.

Gresham College is closely connected with the early history of the Royal Society, which held its meetings there for the most part from 1660 to 1710. [ROYAL SOCIETY.] It escaped the fire of 1666, and was employed temporarily as an Exchange, and to furnish lodgings for the lord mayor, the Mercers' Company, and other bodies belonging to the city. It is remarkable that the court of the Excise-office, on the same spot, has again been offered by government for the same purpose. (*Preface* to Ward's *Lives*; Palmer's *Discourse on the Gresham Foundation*, 1837; Maitland's *History of London* brings the history of the institution fully down to 1755.)

GRESSET, JOHN BAPTISTE LOUIS, born in 1709, at Amiens, studied at a Jesuit's college, and entered their order in the 17th year of his age. He was afterwards sent to Paris, where he completed his studies in the College de Louis le Grand. He was only 24 years old when he wrote his celebrated comic poem entitled 'Vert-vert,' which contains the adventures of a parrot, and is one of the wittiest productions in the French language.* He published soon afterwards 'Le Carême Impromptu' and 'Le Lutrin vivant,' two witty trifles, and also two beautiful epistles entitled 'La Chartreuse,' and 'Les Ombres.' These productions soon acquired great reputation for the author, and he was sent as professor to the college of Tours; but the bigoted sister of an influential minister taking offence at the light tone of Gresset's poetry, accused him before his superiors, who, by way of punishment, sent him to La Flèche. Several of his poetical epistles, as, for instance, 'A' ma Muse,' and 'Au Père Bougeant,' are very well written; but the 'Epître à ma Sœur sur ma Convalescence' may be regarded as a masterpiece. Disliking his residence in La Flèche, he requested his superiors to remove him to some other place, but on meeting with a refusal he left the order in the 26th year of his age, but he always preserved a regard for his old colleagues, which is particularly proved by his 'Adieux aux Jesuits.' He now settled at Paris, where his wit and talents, united with agreeable manners as well as his literary reputation, soon made him the favourite of the best society. In 1748 he was received a member of the French Academy, but he soon afterwards retired to his native city Amiens, where he founded, with the permission of the king, an academy; and having married he settled in the vicinity of the town. In 1774 he was chosen to congratulate Louis XVI. on his accession in the name of the French Academy. The king gave him a patent of nobility, and Monsieur, afterwards Louis XVIII., nominated him historiographer of the order of St. Lazarus.

Gresset died at Amiens in 1777. Besides the productions already mentioned he wrote several plays which have not been very successful, except his comedy 'Le Méchant,' which was performed, for the first time, in 1747. His tragedy of 'Edward III.,' which was performed only once, in 1740, and his 'Sydney,' are both inferior productions. In his latter years Gresset became religiously disposed, and destroyed some unpublished plays as well as two new cantos of 'Vert-vert.' He even condemned his former productions, for which Voltaire was very angry with him. The poems of Gresset are characterised by a charming originality, great ease, a refined humour, and a versification always harmonious. He could give life and animation to the most uninteresting subjects. The best edition of Gresset's works is that of Renouard, published at Paris, 1811, in three volumes.

GRE'TRY, ANDRE'-ERNEST-MODESTE, a very justly celebrated and once most popular composer of French operas, was born at Liége in 1741. At the age of four he gave distinct proofs of the influence which rhythm exercised over his excitable nerves. At six he was placed under a music-master, whose roughness of manners soon rendered it necessary that another teacher should be found for him, and the second proved as gentle as the other had been savage. A company of Italian performers being engaged at Liége, Grétry, then ten years old, was allowed to sing with them in the operas of Pergolesi, Galuppi, &c.; the bent and strength of his genius were proved, and his destiny was fixed. In his eighteenth year he set out for Rome, and commenced his musical studies under Casali.

During a long residence in the capital of the Papal States, then a musical city, Grétry had constant opportunities of hearing the best works of the first masters, which at length inspired him with a wish to try his own powers. An occasion soon presented itself: he was invited by the manager of the Alberti theatre to set a short opera, *La Vendemiatrice*, which met with success of the most decided kind. He was caressed by every order of society, and had the inexpressible gratification of hearing his airs sung in all the streets. He then went to Bologna, and, having stood the customary test of ability, was admitted a member of the *Società Filharmonica*. After this he proceeded to Geneva, and produced his first French opera, *Isabelle et Gertrude*, which was most favourably received. There he formed an acquaintance with Voltaire, which continued to the close of the poet's life.

M. Grétry settled finally in Paris, and immediately commenced that brilliant career which, as an artist, scarcely ever suffered the slightest interruption. He speedily joined the society of the literati of Paris, and with Marmontel his intimacy was close and continued. Intercourse of this kind sharpened his intellect and strengthened his judgment, and much of his success as a composer may be attributed to that vigour of mind which he in a great measure acquired by mixing with men of lively imagination, corrected by education.

At the period of the Revolution, Grétry, then *le Citoyen*, became, to all appearance, a zealous republican; but it is to be suspected that in this he was more guided by what he conceived to be good policy than by natural inclination. He set some of the revolutionary songs, it is true; though, as his biographer in the *Harmonicon* observes, 'his political principles afterwards proved as pliant as those of his friends the *Savans*, and he lived to accept the order of the *Legion d'Honneur* from as deadly an enemy to freedom as history can name.' Napoléon never liked him, and on one occasion he was provoked to rebuke the despotic and rude conqueror in a marked manner. Nevertheless, he was made a member of the French National Institute, Inspector of the *Conservatoire*, &c. In private life he was as virtuous and amiable as unfortunate. Three lovely and accomplished daughters, forming the whole of his family, fell victims to consumption as they successively reached their fifteenth year. He died in 1813, and was buried with great pomp close by Delille, the poet. The people of Liége demanded as a right to have possession of the heart of their distinguished countryman, and the matter underwent long and grave litigation, which terminated in favour of the claimants.

Grétry's operas are too numerous to be all named here

* It has been twice translated into English: 1st, by T. G. Cooper, London, 1759; and, 2ndly, by Alexander Geddes, LL.D., London, 1793.

The best known are, *La Caravane du Caire; Le Tableau Parlant; L'Amitiè à l'Epreuve; Zemire et Azor; Les Mariages Samnites; Richard, Cœur-de-Lion; Barbe-Bleu; Panurge; Cèphale et Procris*, &c. Some of these have been produced on the English stage, with great success; and others have been pillaged by one at least of our deceased pseudo-composers. In 1780, M. Grétry published his *Essais sur la Musique*, in three 8vo. volumes: and in 1793 the republican government printed a second edition of the work. These essays are ingenious, rather entertaining, and exhibit much good musical criticism; but they betray no inconsiderable share of vanity, as well as a want of knowledge of what had already been written on the subject. It is a curious fact, and shows how confined in their studies the French musicians were, even so late as the close of the last century, that Grétry had very little acquaintance with any of Haydn's works; and of Mozart's he either had never obtained a sight, or he must have been incapable of entering into their merits. Notwithstanding this, his essays ought to be read by every studious musician; and many of his compositions deserve to be better known than they can be while so insatiable a thirst for novelty continues to prevail among the influential classes.

GRE'WIA, a genus of plants of the natural family of Tiliaceæ, so named in honour of Dr. Grew, celebrated for his work on the anatomy of vegetables. Though the family takes its name from the European genus Tilia, its species are distributed chiefly through tropical countries. Grewia now consists of upwards of fifty species of moderately sized trees or shrubs, which have leaves resembling those of the elm, yellow or white flowers, and many of them pleasant-tasted subacid fruit. The calyx consists of five coriaceous sepals, which are coloured internally. Petals five, each provided with a gland or scale at the base, inserted with the numerous stamens into the elevated receptacle; germ superior, generally two-celled; style single; stigma four-lobed; drupe with from one to four one-or-two-seeded small nuts. The species of Grewia are found in the tropical islands and the hot parts of the Old World, extending west to the west coast of Africa, and south to the Cape of Good Hope. In India they are common in every part, both in jungly forests and the dry open plains; some of the same species extend from the southern to the most northern parts; a few even ascend the Himalayas to moderate elevations. Species are also found in Arabia and Egypt.

The Tiliaceæ are noted for their mucilaginous properties, as well as for the remarkable tenacity of the inner fibre of their bark, as exemplified in the Tilia, or common European lime-tree: that of Grewia oppositifolia is employed for making ropes with in the Himalayas; and G. elastica, figured by Dr. Royle in 'Illustrations of Himalayan Botany,' t. 22, and called *dhamnoo* by the natives, is valued for the strength and elasticity of its wood. Cattle are fed on the leaves of some species, as G. didyma, at moderate elevations in the Himalayas. The pleasant-tasted subacid fruit of several species is eaten by the natives of India, but principally used for making sherbet. Grewia asiatica, or phalsa, is that principally employed and cultivated in their gardens.

GREY, LADY JANE, born in 1537, remarkable for her virtues, accomplishments, and untimely death, was of the blood royal of England, being the great-grand-daughter of Henry VII., whose daughter Mary married first Louis XII. of France, secondly Charles Brandon, duke of Suffolk, by whom she had a daughter, Frances Brandon, married to Henry Grey, marquis of Dorset. Of this marriage Lady Jane Grey was the eldest daughter: there was no male issue. She was distinguished from childhood by her talents; and her acquirements were certainly, for her age, very unusual. Greek, Latin, Italian, and French, she spoke, and wrote with correctness and fluency; and she understood Hebrew, Chaldee, and Arabic. Great beauty, sweetness of temper, piety, and skill in the usual female accomplishments, combined to render her the delight of all, except her parents, whose severity would in modern times be termed brutal, yet did not alienate her willing obedience. (See Ascham's well known and very beautiful account of an interview with her in his 'Schoolmaster.') Filial obedience proved her ruin. Her father, then created duke of Suffolk, presuming on his own power and favour, and the declining health of Edward VI., undertook in concert with the powerful duke of Northumberland to transfer the crown into their own line. With this view a marriage was concluded between Lady Jane Grey and Northumberland's fourth son, Lord Guilford Dudley, in May, 1553; and Edward VI. was persuaded by his interested advisers to set aside the rights of his sisters Mary and Elizabeth, and his cousin Mary of Scotland; and, in consideration of her eminent virtues and royal descent, to settle the crown upon Lady Jane Grey, or Dudley. The king died July 6th: and it was not until the 10th that this unfortunate lady even knew of the plot in which she was involved. She was very reluctant to accept the crown; but was at last overpersuaded by the importunities of her parents, and the entreaties of her husband, whom she tenderly loved. The two dukes had no party among the people; and ten days placed Mary in undisputed possession of the throne. Lady Jane and her husband were confined in the Tower, apparently without intention of taking their lives in the first instance. But Wyat's insurrection determined their fate. Both were beheaded February 12, 1554. Lady Jane Grey's last hours were marked by the same wisdom, piety, and resignation which distinguished the whole of her short and beautiful life. Her only error was being persuaded to accept a crown, to which she had no good title, and for which she did not wish. (Ascham's *Works*; Burnet, *Hist. Ref.*; *Biog. Brit.*)

GREYHOUND, a variety of dog remarkable for the keenness of its sight, the symmetrical strength and beauty of its form, and its great swiftness in the chace. There are many varieties of the Greyhound, from the Irish Greyhound and Highland breed (the latter made familiar to us by the pen of Sir Walter Scott and the pencil of Edwin Landseer), to the smooth-haired southern breed, and that pretty pet, the Italian Greyhound.

In antient times the Greyhound was one of the three animals whose presence marked the possessor to be a nobleman or gentleman; and we find it recorded as being accepted by kings in payment, as in the case of the fine paid to King John, consisting of '500 marks, 10 horses, and 10 leashes of Greyhounds.'

Formerly this hound was principally employed in chasing the stag. Thus Queen Elizabeth was gratified one day, after dinner, by seeing from a turret sixteen deer pulled down by Greyhounds upon the lawn at Cowdrey Park in Sussex; and the old ballads, 'Chevy Chace' among others, speak of their being used for the same sport in earlier times.

The well-known old lines descriptive of the perfections of a Greyhound have never yet been superseded:

Headed lyke a snake,
Neckyed lyke a drake;
Fotted lyke a catte,
Taylled like a ratte;
Syded lyke a breme,*
And chyned lyke a beme.

In modern times, many distinguished sportsmen (the earl of Orford in particular, who is said to have died on the field where his favourite bitch Old Czarina won a great match) have paid much attention to the breed, and have been rewarded by some of the best dogs ever seen. Major Osbaldeston, Major Topham, and Colonel Thornton were among those who were celebrated for the pure blood and admirable powers of their Greyhounds. The names of Czarina, Jupiter, Claret, Snowball, the Miller, Schoolboy, and Major, together with many others of note, are still familiar to those who attend the great coursing meetings. We refer the reader who is interested to 'The Sportsman's Cabinet,' 'Rural Sports,' 'The Courser's Manual,' 'The Sporting Magazine,' and similar works, for further information.

The Greyhound is supposed to have reached his full growth when two years old, and to be on the decline from his fifth or sixth year, when he is apt to begin to 'run cunning.' Dame Juliana Berners gives a greater latitude, making nine years the point at which he becomes too old for service:

'And when he comes to that yere,
Have him to the tannere,
For the best whelp ever bitch had,
At nine years is full bad.'

Sir Walter Scott, who quotes these lines, well vindicates the character of the Greyhound for intelligence, attachment and sagacity, qualities which some, without any good reason, have denied to this noble race. [Dog.]

GREYWACKE. [Grauwacke.]

GRIESBACH, JOHN JAMES, was born at Butzbach in Hesse Darmstadt, on the 4th of January, 1745, and died

* Some read 'teme.'

on the 24th of March, 1812. Owing to some strange error in Mr. Orme's 'Bibliotheca Biblica,' the date therein given of his birth is the year 1644, according to which he died, not, as the fact is, at the age of 67, but of 168. In early childhood he was removed to, and commenced his grammatical studies in, the Gymnasium at Frankfort-on-the-Main, where his father performed the duties of a Lutheran minister and consistorial councillor. From Frankfort he went, in 1762, to the university of Tübingen, and afterwards passed two years at the university of Halle, whence he removed to that of Leipzig. In 1767 he returned to Halle, and took the degree of M.A.; having, throughout a highly distinguished collegiate course, attended all the lectures of the most eminent professors, and applied himself with unwearied diligence to the critical study of philology, moral philosophy, and especially to theological, biblical, and ecclesiastical literature, in which he received, as a pupil, the most valuable assistance from Semler and Ernesti. He now determined to devote himself wholly to a critical examination of the doctrines and of the Greek MS. texts of the New Testament; and as, in his comprehensive plan of preliminary acquirements, it appeared to be a most desirable object to visit foreign countries, in order to acquire personally a knowledge of the dogmas of their religious sects, and to examine the contents of their principal libraries, he commenced, in 1769, at the age of twenty-four, an extensive literary tour, in which, after inspecting the treasures of the learned institutions of Germany and Holland, he visited and made a sojourn of several months in England, assiduously prosecuting his critical researches in the libraries of the Universities, and of the British Museum, chiefly on his favourite subject of the antient manuscript versions of the New Testament. He next proceeded to visit the libraries of Paris, and of other parts of France, where, as he had done in Germany, Holland, and England, he established an intercourse with many of the most eminent scholars and divines; and having at length collected a large mass of valuable materials, he returned in 1770 to Frankfort, for the purpose of arranging them and applying them to his purpose of producing a new emendation of the text of the Christian Scriptures. In the following year he obtained much applause at the university of Halle, in sustaining, as an academical exercise, a critical dissertation, 'De Codicibus quatuor Evangeliorum Origenianis,' in consequence of which he became theological lecturer, and in 1773 he was appointed Professor Extraordinary of theology at this University. The preparation of his important edition of the New Testament he now prosecuted with great zeal and diligence. Of this valuable work a particular account is given below, with a notice of several of the author's other publications. The reputation he acquired at Halle in correcting and illustrating the sacred text procured for him one of the divinity professorships at the university of Jena, his acceptance of which he signalized by the production of several learned programmes on subjects hereafter named; and on taking, in 1777, the degree of D.D., he sustained a critical dissertation entitled 'Curæ in historiam textûs Græci Epistolarum Paulinarum specimen.' On various other academical occasions he wrote several learned and interesting essays on biblical subjects; he also was one of the directors of the Gazette of Jena; contributed numerous articles to learned periodicals; and in 1780 he was elected rector of that university, and inspector of the students from Weimar and Eisenach; and in the following year he was appointed ecclesiastical councillor to the duke of Saxe-Weimar, was chosen prelate and deputy of the district of Jena, and was made a member of the states of Saxe-Weimar. In the performance of his academical duties he was indefatigable, and usually delivered three lectures daily on theological subjects. The task of perfecting his edition of the New Testament gave him anxious and laborious employment until nearly the time of his death; and, besides his editorial labours, he was actively engaged in the typographical arrangements for the costly and beautiful impression of this work, completed in 1807, for which the types were expressly founded by the eminent printer Göschen. To this brief biographical sketch of Dr. Griesbach, it may be added that, at the age of thirty, he married Frederica Juliana, a sister of Professor Schütz. The first edition of Griesbach's critical emendation of the text of the New Testament was published at Halle in 1774-5, 8vo., in three successive parts, as manuals for the students then attending his course of divinity lectures at Jena. Some bibliological particulars respecting this, and the several subsequent editions, are given in Mr. Horne's 'Introduction to the Bible.' Of the second edition, the first volume appeared in 1796, and the second volume in 1807. This fine impression was made under the careful inspection of the professor himself; and in consequence of the cost of the paper having been munificently defrayed by the chancellor of the university of Cambridge, the Duke of Grafton, the volumes bear the imprint of *Halæ et Londini*. They were handsomely reprinted in London in 1809, and in 1818. In their copious Latin prolegomena are exhibited a critical history of the printed text, a catalogue of all the manuscripts from which various readings are cited, an account of the author's method of proceeding, and rules for determining the comparative value of various readings. Bishop Marsh, in his 'Divinity Lectures' (part ii., sec. 8), has passed a high eulogium on Dr. Griesbach, with regard to this important work, declaring his diligence to be unremitted, his caution extreme, and his erudition profound.

Previous to giving a particular account of the critical system of Griesbach's edition of the New Testament, it will be convenient to name his various other works, several of which form indispensable portions of, or appendages to, the elaborate apparatus of Biblical criticism presented principally in the prolegomena to his New Testament. Nearly the whole of his writings are in Latin, and all are more or less directly devoted to the elucidation of Biblical subjects, as follows:—

'Dissertatio de Fide Historica, ex ipsa rerum quæ narrantur natura judicanda,' 4to., 1764; 'Dissertatio Hist. Theol. locos Theologicos ex Leone M. Pontifice Romano sistens,' 4to., 1768; 'Dissertatio de Codicibus quatuor Evangeliorum Origenianis,' 4to., 1771; 'De vera Notione Vocabuli Græci, in cap. 8, Epistolæ ad Romanos, 1 et 2,' 4to., 1777; 'Curæ in Historiam Textûs Græci Epistolarum Paulinarum,' 4to., 1777; 'Programma de Fontibus unde Evangelistæ suas de Resurrectione Domini Narrationes hauserint,' 1784; 'Programma de Imaginibus Judaicis quibus Auctor Epistolæ ad Hebræos in describenda Messiæ provincia usus est,' 4to., 1792; 'Anleitung zum Studieren der Popularen Dogmatik,' 1789 (Introduction to the study of the popular Christian dogmas). This, from the nature of its object, became the most popular work of the author; and in ten years after its publication had passed through a fourth edition. 'Commentarius Criticus in textum Græcum Novi Testamenti,' 1798 and 1811; 'Commentatio quâ Marci Evangelium totum e Matthæi et Lucæ Commentariis decerptum esse monstratur,' 4to., 1789; 'Recognita multisque augmentis locupletata in Commentationibus Theolog.,' 1794. Griesbach's 'Opuscula Academica' were edited by the learned Jo. Phil. Gabler, and published in 8vo. at Jena, in 1824. 'Symbolæ Criticæ, ad supplendas et corrigendas variarum Novi Testamenti Lectionum Collectiones: accedit multorum Novi Testamenti Codicum Græcorum descriptio et examen,' 2 tom., 8vo., 1785-93. A most important work, containing a full development of the author's system of Biblical criticism. The second volume contains a laborious collation, with the Greek Vulgate, of all the quotations from the New Testament made by Origen and Clemens Alexandrinus. 'Synopsis Evangeliorum Matthæi, Marci, et Lucæ, una cum iis Joannis Pericopis, quæ Historiam Passionis et Resurrectionis Historiam complectuntur,' 8vo., 1797. Bishop Marsh recommends this synopsis of the three first gospels as preferable to every other Harmony. (Michaelis, *Introduc.*, vol. iii., part 2, p. 47.) However, as some of the transpositions have been deemed arbitrary, and several important passages have been omitted, the work has become the basis of a more complete synopsis by De Wette and Lücke, published in 4to. at Berlin, in 1818.

Of all modern critical editions of the New Testament, Griesbach's is generally considered to be the most complete and valuable, and consequently his text has been taken as a standard by numerous other editors. His marginal notes, as forming a general and correct index to the great body of collated Greek manuscripts (about 500), are a treasure invaluable to the scholar and necessary to the divine. Every emendation is introduced on quoted authority, and never on mere critical conjecture; and a very important advantage, not previously afforded, is a clear and precise statement of the relative degree of authority for each particular reading. Adopted readings are distinguished by a different type; those rejected are inserted in the margin with appropriate references, and those not admissible into

the text, but yet worthy of consideration, are exhibited with indications of their respective claims. It is generally agreed that the best practical mode of distinguishing authentic from spurious readings is decidedly the classification of manuscripts suggested by Bengel and Semler, and reduced to practice by Griesbach, who distinctly avows the derivation of his plan from those distinguished critics. (*Prolegom.* in New Testament.)

The peculiar principle of Dr. Griesbach's system consists in a division of the Greek MSS. of the New Testament into *three* classes, each of which is considered as an independent witness for the various readings of the MSS. which it comprises. He thus contemplates the existence of three distinct species of texts, which, with respect to their relationship or affinity, are called by Bengel *families*, and by Semler, Griesbach, and Michaelis, *recensions*, or *codices*, namely:—1. The *Alexandrine* recension or codex, comprehending MSS. which, in peculiar readings, agree with the citations found in the early Greek-Egyptian Fathers, particularly Origen and Clemens of Alexandria. 2. The *Western* recension, which is identified with the citations of the Latin Fathers, especially Cyprian and Tertullian, and was used by the Christians of Carthage, Rome, and the west of Europe. 3. The *Byzantine* or Asiatic recension, comprising numerous MSS. which were used especially in the see of Constantinople and the adjacent Oriental provinces, and have furnished the Received Text, called the Greek Vulgate. Each of these recensions has characteristics peculiar to itself, yet no individual MS. exhibits any recension in a pure state, but is assigned to the Alexandrine or Western class, as the peculiar readings of each of those classes preponderate. Though Griesbach considers departures from the received Greek Vulgate as various readings, he does not allow the existence of any standard text as a criterion for determining which are genuine or spurious readings; his object being to show, not the character of particular deviations from any individual recension, but the general coincidences of MSS. with one recension or codex more than with another. The authorised text does not regulate, but is regulated by, his critical opinion of its comparative value; and the immense number of various readings form a floating medium in which the genuine text is considered to be in all instances discoverable. However, although he professes to determine the value of readings by the number of classes by which they are supported, he constantly displays a very decided preference of the Alexandrine class, which he places far above the two others in the rank of authority; a few MSS. of this recension being supposed to outweigh a multitude of such as belong to the Byzantine recension, which he regards as certainly the most untrustworthy of all. (*Prolegom.* lxxii.) The reason assigned by Griesbach for this decision is the fact that, the Greek transcripts of this class contain a remarkably large number of suspected readings, owing to the very great liberties taken by learned copyists in making successive alterations; and finding the coincidence of the numerous Scriptural quotations of Origen of Alexandria with the celebrated Greek MS. of the New Testament from that city to be very striking, he thence concludes that the passages now extant in this Father's writings, of the commencement of the third century, discover the earliest and therefore the purest text of which we have any knowledge to be that of the Alexandrine MSS. His ultimate choice of readings is consequently determined by the testimony of Origen, in confirmation of which he often adduces much collateral evidence from the primitive fathers and versions; and of the readings thus proved to be genuine is formed his corrected text of the New Testament.

Against the complicated hypothesis on which Dr. Griesbach has based his system of recensions many very important objections have been urged by learned Biblical critics of Germany, and in England especially by Archbishop Lawrence and Dr. Frederic Nolan. The primary fact enforced by Griesbach, that the Alexandrine readings which are supported by the quotations of Origen possess the highest authority of all, is disputed by Professor Matthiæ, of Moscow, in his critical edition of the New Testament, and with greater confidence by Professor Martin Scholz, of Bonn, in the prolegomena to his very learned and elaborate edition, founded on a system wholly at variance with that of Griesbach. The Alexandrine MSS. are acknowledged by Scholz to be more antient, but he asserts them to be more corrupt than any others, and contends that in Alexandria the alterations of the text principally originated. He divides all the MSS., not as Griesbach, into three, but into two classes, the Byzantine and the Alexandrine, in which latter he includes the Western; and he gives a decided superiority to the authority of the Byzantine recension, which, in opposition to Griesbach, he strenuously maintains to be directly derived from the autographs of the evangelists and apostles themselves. The work by Archbishop Lawrence on this subject is entitled 'Remarks upon the Systematical Classification of MSS. adopted by Dr. Griesbach,' 8vo., 1814. The learned author states that, he considers Griesbach to be what Bishop Marsh denominated him, 'the most consummate critic that ever undertook an edition of the New Testament;' but in the course of his critical strictures on the origin and execution of his plan of appreciating MSS., he employs the severest terms of censure, observing that 'Griesbach's mode of investigation is unsatisfactory, his classification fallacious, and his statement of the number of readings inaccurate; that no such classification of the MSS. of the New Testament is possible; the existence of three distinct species of texts being a fact only synthetically presumed, and not capable of any analytical demonstration: so that the student finds he is treading not on solid ground, but on a critical quicksand.' Griesbach was long and severely attacked by Trinitarian writers as an opposer of the doctrine of Christ's divinity, chiefly in consequence of his having rejected from his text the celebrated passage respecting the three that bear witness, 1 John, v. 7, and also for inserting ὁς for Θεός in 1 Tim. iii. 16, and Κυρίου for Θεοῦ in Acts xx. 28. In consequence of these and other points in his critical works the commendation and patronage of the Unitarians were bestowed upon him; but in the preface to his treatise on the apostolical writings, he makes the following solemn declaration:—'Ut iniquas suspiciones omnes, quantum in me est, amoliar, et hominibus malevolis calumniandi ansam præripiam, publice profiteor, atque Deum testor, neutiquam me de veritate istius dogmatis dubitare;' and to this may be added a statement from his 'Prolegomena,' namely, that 'nulla emendatio a recentioribus editoribus tentata ullam Scripturæ Sacræ doctrinam immutat, aut evertit,' though 'paucæ sensum sententiarum afficiunt.' The laborious and minutely learned work by the Reverend Dr. Nolan, entitled 'An Enquiry into the Integrity of the Greek Vulgate, or Received Text of the New Testament,' published in 1815, is chiefly occupied in presenting evidence to subvert the critical system of Griesbach, and to establish the position since taken by Professor Scholz and others, that the Byzantine, and not the Alexandrian, codices are the most worthy of reliance. 'Griesbach's theory,' says Dr. Nolan, 'is one of the most elaborate of those that have unsettled the foundation on which rests the entire canon. His corrected text can be received only as a proof of the general corruption of the Sacred Scriptures, and of the faithlessness of the traditionary testimony by which it is supported, since he states that the two principal classes of text, the Alexandrine and the Western, have been interpolated in every part; that the authorized Greek version exhibits 150,000 various readings, and has remained 1400 years in its present state of corruption; that there appears therefore to be no reservation by which the doctrinal integrity of the Sacred Scriptures can be saved; for if, in the apostolic and primitive ages, corruption was prevalent, whatever be the text gathered out of the immense number of various readings, it may be as well any other as that originally delivered by the inspired writers.' Griesbach indeed declares, in his 'Symbolæ Criticæ,' that the MSS. of the Alexandrine and Western recensions, on which his system is founded, were grossly corrupted in the age succeeding that of the apostles; that those which he held in the highest esteem were corrupted in every page by marginal scholia and interpretations of the fathers, and contained innumerable and very serious errors ('innumeros gravissimosque errores'). He further states in the same treatise that no reliance can be placed on the printed editions of the works of Origen, on the fidelity of his different transcribers, on the accuracy of his quotations, or, finally, on the copies of the Scriptures from which he quoted; so that, as observed by Dr. Nolan, we have only to take his own account of the state in which he finds the best part of his materials to discover the extreme insecurity of the fabric which he has raised on such a foundation. 'His innovations,' continues the same learned divine, 'are formidable in number and

nature; his corrections proscribe three important passages (already named) affecting the doctrinal integrity of the inspired text; for a proof once established of its partial corruption in important matters must involve its character for general fidelity; and the deservedly high character and singular merit of this learned edition must heighten apprehension and alarm at the attempts thus made to undermine the authority of the Received Text, for the scrupulous accuracy of its execution must always command respect.' In addition to the works above-mentioned, reference has been made to the 'Life of Griesbach' by Professor Köthe (in German); to Horne's 'Introduction to the Holy Scriptures,' 7th ed., vol. ii., p. 22, &c.; to Dr. Seiler's 'Biblical Hermeneutics,' pp. 340-360; &c., &c.

GRIMM, F. M. (BARON), was born at Ratisbon, 1723, of poor parents, who gave him however an excellent education. Having finished his studies he published a tragedy called 'Banise,' which proved a complete failure. He afterwards accompanied a young Count Schoenburg to Leipzig and to Paris, where he became a reader to the duke of Saxe-Gotha. This place however was more honourable than lucrative, and Grimm was in very narrow circumstances when he made the acquaintance of J. J. Rousseau, which became a close intimacy, strengthened by the fondness for music of both of them. Rousseau introduced him to Baron Holbach, Madame D'Epinay, and other persons distinguished either by their rank or talents. When Paris became divided between the partisans of the French and Italian music, Grimm declared for the latter and became the leader of the *Coin de la Reine*, a party so called on account of their assembling in the pit, under the box of the queen, while the opposite party, assembling under the box of the king, was called *Coin du Roi*. Grimm wrote on the occasion a witty pamphlet, entitled 'Le Petit Prophéte de Boemischbroda,' Paris, 1753. His opponents tried to answer him, but were entirely beaten out of the field by another pamphlet entitled 'Lettres sur la Musique Française.' His antagonists now talked about banishment or the Bastile, but the excitement soon subsided, and the author received universal praise. On becoming secretary to Count Friesen he obtained still easier access to the higher circles of society, where his chief object was to gain the favour of the ladies by the elegance of his conversation, manners, and external appearance. His relations with the editors of the 'Encyclopédie,' and with many other eminent individuals of France, as well as his talents and great tact, opened to him a brilliant career. On the death of Count Friesen he became secretary to the Duke of Orleans, and began also at that time to write for several German princes his literary bulletins, which contained exceedingly clever analyses of all the more important literary productions of France.

In 1776 he was nominated by the Duke of Gotha his minister at the French court with the title of baron, but this circumstance did not interrupt his literary occupations. He left France at the Revolution, and retired to Gotha. In 1795 he was nominated by the Empress Catherine of Russia her minister at Hamburg, a post which he occupied for some time, until a severe illness, by which he lost an eye, compelled him to resign it. He returned to Gotha, where he died in 1807. After his death appeared his 'Correspondence Littéraire, Philosophique, et Critique,' 16 vols., Paris, 1812; another edition with a supplement, by Alexander Barbier, 1814; and a new edition, more complete than either of the preceding, was published at Paris, 1829, in 15 vols.

GRIMSBY. [LINCOLNSHIRE.]

GRINDELWALD. [BERN, vol. iv., p. 302.]

GRI'SLEA, a genus of tropical plants of the natural family of Lythrariæ, called Salicariæ by some botanists. The genus is characterised by having a tubular calyx, which is from four- to six-toothed; the petals, four to six in number, are inserted between the divisions of the calyx; the stamens, twice as many, arise from the bottom of the calyx, and have their long filaments extending with the style beyond its tube; the capsule is superior, two-celled, many-seeded, and covered by the persistent calyx. The plants of this genus consist of shrubs, with opposite, very entire leaves, dotted on the under surface with dark-coloured glands. The peduncles are axillary and many-flowered; the flowers reddish-coloured. The species are not more than three in number, of which one, G. secunda, is found in the warmer parts of South America, and the others in India. Grislea tomentosa, the best known and most useful species, is found in the islands of the Indian Ocean, in China, and in every part of the continent of India, especially in the jungly tracts at the foot of its several ranges of mountains. In such situations its bright red calyx, retaining its colour till the seeds are ripe, gives the whole plant a very showy appearance, and points it out to the collectors of its flowers, which form an article of commerce. These are much employed by the natives of India for dyeing a red colour, and, having some degree of astringency, are also employed in Indian medicine. The plant is known by the names of *Dharee*, *Dhaee*, &c., and the flowers by that of *Dhaeephool*.

GRISONS. [GRAUBÜNDTEN.]

GRIT. Hard sandstones are called grits in the north of England, and indeed many soft sandstones are so termed. In particular districts some distinctive terms are applied, as millstone grit, red grit, white grit, grindstone grit, &c. Almost universally in the north of England the term 'freestone' belongs to such gritstones as will work easily and to a good face; 'calliard' stones are intractable, close-grained, almost flinty grits; in Aldstone Moor, Cumberland, the term 'hazel' is given to some hard grits; at Newcastle the word 'post' signifies a 'bed,' and is generally associated with gritstone rocks.

In geology the most remarkable rocks to which the word grit is applied, are—the calcareous grit (in which however there is often little of calcareous matter), a part of the middle oolite formation; the millstone grit, which contains beds of quartz pebbles, and is altogether a coarse irregularly laminated rock.

GROCYN, WILLIAM, one of the revivers of literature, was born at Bristol, in 1442, and received his early education at Winchester School. He was elected thence to New College, Oxford, in 1467, and in 1479 was presented by the warden and fellows of that society to the rectory of Newton Longueville, in Buckinghamshire. In 1485 he was made a prebendary of Lincoln; and in 1488 sat out upon his travels into foreign countries. His great object was to obtain a perfect knowledge of the Greek language, which was then but little cultivated in England. Accordingly he went into Italy, where he studied for some time under Demetrius Chalcondylas, Politiano, and Hermolaus Barbarus. He returned to England, and fixed himself in Exeter College, Oxford, in 1491, where he took the degree of B.D. Here too he publicly taught the Greek language, and was the first who introduced a better pronunciation of it than had been before known in England. The cultivation of this language however in the university alarmed many as a dangerous innovation; and Wood informs us that the members became divided upon it into two factions, distinguished by the appellations of Greeks and Trojans. It was at this period that Erasmus visited Oxford, and resided during the greater part of his stay there in Grocyn's house. Erasmus, who mentions him with great and merited commendation, calls him 'patronus et preceptor.' In the course of his career Grocyn had one or two other preferments, and in 1506 became master of Allhallows College, at Maidstone, in Kent, though he continued to live mostly at Oxford. He died at Maidstone, in 1519, of palsy, with which he had been seized a year before. His will is printed in the Appendix to Knight's 'Life of Erasmus.' A Latin epistle of Grocyn to Aldus Manutius is prefixed to Linacre's translation of Proclus' 'De Sphæra' at the end of the 'Astronomi Veteres' of 1499. The productions ascribed to him by Bale, Leland, and Tanner are not extant in print. (Knight's *Life of Erasmus*; Erasmi *Epist.*, fol., Lugd. Bat., 1706, pp. 95, 294; Wood's *Athenæ Oxon.*, ed. Bliss, i., 30-32.)

GRODNO, a western province or government of Russia in Europe, lying between 51° 31′ and 54° 21′ N. lat., and 23° 49′ and 26° 44′ E. long. It is composed of a portion of the grand-duchy of Lithuania and other eastern parts of the kingdom of Poland, which Russia wrested from it in the year 1795. Its area has been variously estimated, but it is stated approximately by Schnitzler at about 14,700 square miles, which is a larger area than that of the kingdom of Hanover. Its greatest length is about 173 miles (260 versts), and its greatest breadth about 120 miles (180 versts). The surface is a wide plain, and it has numerous forests, particularly in the north, and swampy lowlands. The soil is either a pure sand, or alluvial deposit intermixed with sand, and is in general favourable to the cultivation of grain and feeding of cattle. The principal river is the Niemen, which becomes navigable at Lititsha before it reaches

Grodno, and is augmented in this province by the waters of the Shtshara, the western Beresina, Rossa, Kotra, &c. In the south-west the Bug separates Grodno from Poland, and the Narew, a tributary of the Vistula, rises in the circle of Prushana. The winter is very cold, and the climate damp and foggy.

Of barley, which with rye is the grain most cultivated, one-third is exported; large quantities of oats, hops, hemp and flax, are also raised. Vegetables and fruit are not of extensive growth. The crown holds a great number of the forests of Grodno, which are chiefly of the pine species, particularly the forest of Bialovéya, or Bielovieeza, in the circle of Prushana, the circuit of which is about 106 miles, and within which are several villages and settlements belonging to the crown. Horned cattle and sheep of improved breeds are fed in considerable numbers. Much wax and honey are made; but the fisheries are unproductive. The minerals, which are insignificant in point of produce, consist of iron, limestone, clay, chalk, and saltpetre.

The population in the northern circles of Grodno and Lida is of Lithuanian descent; in the remaining circles it is Russniack. Besides many Jews there are Tartar and German colonists in the province. The inhabitants are estimated at 800,000, of whom about 22,600 are Shlakhtitzes (nobles), and 25,000 Jews. Of the peasantry, amounting to between 500,000 and 600,000, Lakhnitzki affirms that in 1816 only 1097 had acquired their freedom. Grodno is divided into eight districts, and contains eight chief towns, 108 minor towns, 936 villages, and 559 churches and religious establishments. The eight chief towns are,—Grodno; Lida, with a castle, college, and school, 1200 inhabitants; Novogrodek, with 6 churches and 3 monasteries, a mosque, 2 synagogues, and 2000 inhabitants, mostly Jews; Slonim, on the Shtshara, with 7 churches, a large woollen manufactory, and of Jewish population about 2000; Wolkovyek, chief town of the circle, about 500: Prushana, chief town of the circle, an insignificant place; Kobryn, on the Muchaviec, with a monastery, and about 1500 inhabitants; and Brzesc, at the efflux of the Mushaviec into the Bug, a walled town, with an imperial palace, 12 churches and 2 synagogues, 463 houses, and about 3650 inhabitants, who carry on an extensive trade.

The province is advancing in manufactures, though in 1830 it did not contain more than 37 establishments, which employed 1940 hands. Their produce is woollens, hats, leather, paper, and spirits. It has a good export trade in grain, wool, cattle, timber, and its other productions, particularly with Memel, Riga, and Königsberg.

GRODNO, the capital of the province, is situated at the foot and on one side of an eminence on the right bank of the Niemen, about 660 miles south-west of St. Petersburg, in 53° 40′ N. lat., and 23° 52′ E. long. It is the seat of government for the province, and occupies a large extent of ground, but has neither walls nor gates; it is in a somewhat decayed condition, little pains having been taken to restore it since the great fire in 1753. In the year 1816 the number of houses was 1109, of which 122 only had stone or brick walls, the remainder being of wood. The Jews were owners of 576 of the houses at that time, and the population was 5091. At present the official returns state it to be upwards of 10,200. The town is as old as the twelfth century, and had an antient palace surrounded by a deep mote, which, with the exception of one wing, is now uninhabitable. The modern palace, erected by Augustus III., king of Poland, is spacious, handsome, and regularly built, and opposite to the quadrangle in front of it is a fine building containing the government offices. Grodno has 8 Roman Catholic churches, 2 for the united Greek and Catholic worship, a Greek church, a Lutheran chapel, and 2 synagogues, one of them in stone. The churches of the former college of Jesuits and of the Carmelite convent are very fine. The Greek abbey of St. Basil is also a handsome structure. There are two noble palaces belonging to the Radzivil and Sapieha families, and a good market-place; an equestrian seminary, a high school, and several other seminaries, besides the academy for medical science, with its library, collections in natural history, and botanic garden, founded by Stanislaus Augustus. The same monarch set some manufactories on foot at Grodno; a few of them still subsist, and comprehend woollens, silks, hats, cards, and wax. The fairs, held three times a year, are well attended. The Niemen affords great facilities for commercial intercourse. Grodno was for a short time after 1673 the place of meeting for every third session of the Polish and Lithuanian Diets, but they were afterwards transferred wholly to Warsaw. The Diet held here in 1795 was for the mere purpose of ratifying the dismemberment of Poland. Grodno, two years after this, was the place of Stanislaus Augustus's abdication of the Polish crown. About 18 miles north of the town are the mineral baths of Deuskinicki.

GROINS, the lines formed by the intersection of arched vaultings. Such intersections are called 'groinings,' and the vaultings 'groined arches.' The largest groined arches built by the antients are, we believe, those of the baths of Diocletian, at Rome. Groins, which arose in the first instance out of the simple intersection of arches, were in later times the foundation of an extensive system of decoration. This system is exemplified in the elaborately groined ceilings of many of our ecclesiastical buildings.

Groined arches are constructed of stone, brick, and wood and plaster When constructed with stone or brick a centering of wood is used to turn the arch and form its groins. 'The centering consists of several ribs, disposed at three or four feet distance, made to the size of the vault which has the greatest opening. The extremities of these ribs rest on beams supported by standards, and are boarded over, without any regard to the transverse openings, which are afterwards formed by another set of ribs adapted thereto, and then boarded so as to meet the boarding of the first vault, which, if of considerable breadth, must have short ribs fixed upon its surface, in order to shorten the bearing of the boarding of the transverse opening; and thus the centering will be completed.' (Nicholson's *Architectural Dictionary*.)

Nicholson gives the following rules for constructing the centering for groins, first premising that 'It is obvious that in forming the ribs for each vault the outer curve must be the arc of a circle or ellipsis within the curve of the vault, and distanced from it towards the axis equal to the thickness of the boarding. In making the groined centre, it will be necessary to find the place of the angles on the boarding of the large vault, in order to ascertain the place of the ribs and boarding of the transverse vault. This may be done by three different methods. First, let two straight edges be placed vertically at the angles, and a third straight edge, or an extended line, be made to touch the surface of the boarding, and marked at all the points of contact, keeping the latter straight edge or line always upon the edges of the two vertical straight edges. The defect of this method is, that the place of the angles at the bottom can never be found, since it would require the cross straight edge or line to be of infinite length, and the vertical ones of infinite height. A more eligible method therefore, where there is room, is, secondly, to fix two ribs in the transverse part, and direct a level straight edge upon their edges, so that the end may come in contact with the boards, and mark the boarding in this place; find a sufficient number of points for the purpose, in the same manner, and draw curves through the points, which will give the curves for fixing the end of the filling-in ribs, otherwise called jack-ribs. In constructing groins to be finished with plaster the angle-ribs must be first fixed, then straight longitudinal pieces parallel to the axis of the groin fixed, either flush with the under side of the angle-ribs, or their under sides a little below those of the angle-ribs, so as to admit of their being nailed together: this is the most eligible method of constructing plaster groins.' Great nicety is required in the execution of the groined work, and the best workmen among bricklayers and masons are always selected. The elaborate groined ceilings of Gothic structures are rarely executed now; some of these groinings are in stone, others in plaster. [Gothic Architecture.] Brick groinings are very common, and few modern churches and large warehouses are now constructed without a series of groinings in the basement floors. The bricks are cut with the trowel and rubbed smooth, and the angle to which the brick is cut is constantly varying. For various diagrams showing the constructions of the centres of groins, we refer the reader to the plate in Nicholson's 'Dictionary,' with his practical methods and inventions for constructing centres.

GRONINGEN, a province in the kingdom of the Netherlands, bounded on the north by the German Ocean, on the east by the kingdom of Hanover, on the south by the province of Drenthe, and on the west by the province

of Friesland. It lies between 52° 49′ and 53° 27′ N. lat., and between 6° 14′ and 7° 10′ E. long.: its greatest length from south-east to north west is 50 English miles, and its mean breadth about 15 miles its area is 770 miles.

The whole province is a perfect level, intersected everywhere by canals and ditches, and protected from the sea by dykes. A great proportion of the land is marshy, and unfit for any purpose but pasturage, which however is rich, and supports a fine breed of cattle. The province is divided into three districts, Groningen, Winschoten, and Appingadam. The only town of any importance is the capital, Groningen.

The population in 1815 was 135,642, in 1824 it had increased to 153,860, or at the rate of about 1⅓ per cent. annually. The population of the towns was 29,741, and of country districts 124,119. The births and deaths during the 10 years from 1815 to 1824 inclusive were—

	BIRTHS.			DEATHS.		
	Males.	Females.	Total.	Males.	Females.	Total.
Towns . .	5,290	5,031	10,321	4,009	3,882	7,891
Country . .	21,249	20,103	41,352	11,752	10,896	22,648
	26,539	25,134	51,673	15,761	14,778	30,539

The number of marriages in the same 10 years was 11,492, and of divorces 37.

In 1825 there were in the province 77,244 head of cattle, 22,973 horses, and 62,844 sheep.

The linen and woollen manufactures are carried on to a small extent in the province. A considerable number of the inhabitants on the coast employ themselves in the fisheries, but the great bulk of the people are engaged in husbandry and grazing.

The capital, Groningen, is situated at the confluence of the two rivers Hunze and Aa; it is a large, populous, and well built town, nearly circular in its form, and surrounded by walls and a fosse. The great church of St. Martin, which was begun in 1468 and not finished until 1627, is a very fine building with a remarkable organ. Groningen contains an academy, founded in 1614 and well endowed, which enjoys a good reputation; a public library; and an institution for the deaf and dumb.

The Hunze is navigable up to the town for vessels of considerable burthen: there is a good harbour, and a considerable trade is carried on in corn, cattle, and other agricultural products. The population is about 25,000.

Winschoten, the only other town in the province that requires notice, is about 17 miles south-east from Groningen. It is fortified and difficult of approach to an enemy on account of the marshes by which it is surrounded: the population is about 2500.

GRONO'VIUS, the Latinized form of Gronov, was the name of a family originally from Germany, but settled in Holland, several members of which distinguished themselves by their classical learning in the seventeenth and eighteenth centuries.

1. John Frederic Gronov, born at Hamburg in 1611, studied at Leipzig, Jena, and Altdorf, travelled through Holland, England, France, and Italy, was appointed professor of belles-lettres at Leyden in 1658; he died in 1671. He published editions of several of the classics, such as Livy, Sallust, Seneca, Pliny, &c. He wrote—1. 'De Sestertiis, seu Subsecivorum Pecuniæ veteris Græcæ et Romanæ, libri iv.,' Deventer, 1643, republished with important additions by his son James Gronovius, Leyden, 1691; 2. 'De Musæo Alexandrino Exercitationes Academicæ;' 3. 'Lectiones Plautinæ, quibus non tantum fabulæ Plautinæ et Terentianæ, verum etiam Cæsar, Cicero, Livius, illlustrantur,' Amsterdam, 1740; and other works of classical erudition.

2. James Gronovius, elder son of the preceding, born at Deventer in 1645, showed from early youth a great aptitude for philological studies. He published numerous editions of the Greek and Roman classics, among others of Herodotus, Polybius, Macrobius, Aulus Gellius, Tacitus, &c. But the work by which he is best known is the 'Thesaurus Antiquitatum Græcarum,' 13 vols. fol., Leyden, 1697, enriched with engravings of mythical and historical personages, of monuments and other remarkable objects illustrative of the arts, customs, and history of antient Greece, copied from antient sculptures and medals, and disposed in order of time. He also published 'Geographi Antiqui,' 2 vols. 4to., Leyden, 1694. Gronovius, after travelling through various countries of Europe, was appointed by the grand duke of Tuscany professor of belles-lettres in the university of Pisa. After two years he returned to Holland, in 1679, and filled the same chair, as professor in the university of Leyden, which his father had occupied before him. He died at Leyden, in 1716. Gronovius, unlike his father, was fond of polemics, in which he was lavish of hard words and abuse. [FABRETTI.] Niceron, in his 'Mémoires,' has given a list of all his works.

3. Abraham Gronovius, eldest son of James, a physician of some reputation, wrote also several works on subjects of classical erudition, such as 'Varia Geographica,' 8vo., Leyden, 1739, being a collection of dissertations and notes in illustration of antient geography; he also published a good edition of Justinus, 8vo., Leyden, 1760, adding his own notes to those of his grandfather J. Fred. Gronovius, of Is. Vossius, Grævius, Fabri, and others, and subjoining a copious index.

4. Laurentius Theophilus Gronovius, younger brother to James, published 'Emendationes Pandectarum juxta Florentinum exemplar,' Leyden, 1685, which he dedicated to Magliabecchi, with whom both he and his brother had become intimate while in Italy. He also contributed to his brother's 'Thesaurus,' and to the 'Varia Geographica' of his nephew Abraham.

GROOM, in old English, meant a servant in some mean station, a lad or lacquey who was sent on errands: and is said, by Kilian, to be derived from the Flemish *grom*, a boy. It answered to the French *garçon*. At present, in common life, groom means a servant especially attendant on the stable. Jamieson says the original word was *gom*, and that the letter *r* has been inserted only in English and Scotch.

In higher life, groom is the denomination of several officers or servants of the royal household, mostly in the lord chamberlain's department: such as grooms in waiting, grooms of the great chamber, grooms of the privy chamber, groom of the robes or stole, and, in the lord steward's department, groom of the almonry.

There was formerly also, in the lord steward's department, a *groom-porter*, who is said to have succeeded to the office of master of the revels, then disused. His business was to see the king's lodging furnished with tables, chairs, stools, and firing; as also to provide cards, dice, &c., and to decide disputes arising at cards, dice, bowling, &c.

From allusions in some of Ben Jonson's and Chapman's plays, it appears that the groom-porter was formerly allowed to keep an open gambling-table at Christmas: it is mentioned as still existing in one of Lady Mary Wortley Montagu's eclogues:—

"At the *groom-porter's* batter'd bullies play."
Thursday, Ecl. 4. Dodsley's *Collect.* i. 107.

This abuse was removed in the reign of George III. Bray in his account of the Lord of Misrule, in the 'Archæologia,' vol. xviii., p. 317, says, George I. and II. played hazard in public on certain days, attended by the groom-porter. The appellation however is still kept up: the names of three groom-porters occur among the inferior servants in the present enumeration of Her Majesty's household.

GROSBEAK. [FRINGILLIDÆ; HAWFINCH.]

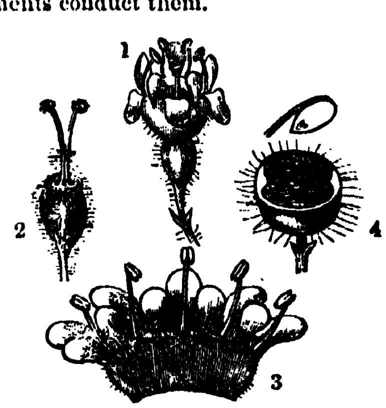
GROSE, FRANCIS, an eminent English antiquary, was the son of Francis Grose, a native of Switzerland, who, settling in England, followed the trade of a jeweller, and was employed as such in fitting up the crown for the coronation of King George II. Francis Grose the younger was born at Greenford in Middlesex, according to Noble; Chalmers says in 1731. His taste for heraldry and antiquities induced his father, at an early period, to procure a place for him in the Herald's College, where he received the appointment of Richmond Herald, a post which he resigned in 1763, when he became adjutant and paymaster of the Hampshire militia. At a subsequent time he was a captain in the Surrey militia. His father, who died in 1769, left him an independent income, which he had unfortunately neither the disposition to increase nor the prudence to preserve. Whilst paymaster of the Hampshire militia, he used jocosely to say that he had only two books of accounts, his right and left hand pockets. In the one he received, and from the other paid. Designing persons, of course regarded him as their dupe: and he soon felt the effects of his credulity. His losses however roused his latent talents. To a good education he united a taste for drawing, which he now

began again to cultivate, and, encouraged by his friends, he undertook a work from which he derived both profit and reputation. He began to publish his 'Views of Antiquities in England and Wales' in 1773, in numbers, and finished them in 1776. In 1777 he resumed his pencil, and added two more volumes to his 'English Views,' in which he included the islands of Guernsey and Jersey. In the summer of 1789 he set out on a tour to Scotland, the result of which he began to communicate to the public in 1790, in numbers: but before he had concluded this work, in the spring of 1791, he went to Ireland, intending to furnish that kingdom with views and descriptions of her antiquities in the same manner in which he had done those of Great Britain: but soon after his arrival in Dublin, at the house of a Mr. Hone, he was suddenly seized at table with an apoplectic fit, on May 12th, and died immediately.

Captain Grose's other publications were, a 'Treatise on Antient Armour and Weapons,' 4to., 1785, to which he added a Supplement, 4to., 1789; a 'Classical Dictionary of the Vulgar Tongue,' 8vo., 1785; 'Military Antiquities,' 2 vols. 4to., 1786-8; the 'History of Dover Castle, by the Rev. William Darell,' 4to., 1788; 'Rules for Drawing Caricatures,' 8vo., 1788; and a 'Guide to Health, Beauty, Honour, and Riches; a collection of numerous advertisements, pointing out means to obtain those blessings,' 12mo. The 'Olio,' a collection of essays, and other small pieces highly characteristic of Mr. Grose, and bearing his name, but certainly not made entirely by him, was published in 8vo., 1793. The 'Antiquities of Ireland' were completed by Mr. Ledwich, and published in two volumes, 4to. and 8vo., 1794.

Those who knew Captain Grose say that his literary acquirements were far exceeded by his good-humour, his conviviality, and his friendship. In person he was remarkably corpulent. (Noble's *Hist. of the College of Arms*, 4to., 1804, pp. 435, 436; Nichols's *Lit. Anecd.*, vol. iii., p. 656-659; Chalmers's *Biogr. Dict.*, vol. xvi., pp. 370, 371.)

GROSSULA'CEÆ, a natural order of Exogenous plants, chiefly remarkable for comprehending the gooseberry and currant of the gardens; and consisting in fact of only one genus, Ribes, of which these fruits are different species. The order belongs to the albuminous series, and is, no doubt, allied as closely to the vine as to anything else, as its succulent fruit, lobed leaves, and racemose inflorescence seem to indicate. It however differs very essentially in having a superior calyx, into the sides of which the stamens are inserted, and in its fruit containing but one cell, with parietal placentation. The French school of botany place Grossulaceæ near Cactaceæ and Saxifragaceæ on account of their perigynous stamens; to such startling results does the artificial part of their systematical botanical arrangements conduct them.



Ribes Grossularia.

1, A flower magnified; 2, the ovary and styles, from which the calyx, petals, and stamens have been cut off; 3, a calyx laid open, to show the petals and the insertion of the stamens; 4, a transverse section of a fruit exhibiting the parietal placentation; 5, a longitudinal section of a seed, with the minute embryo at the end of the albumen.

GROTIUS, HUGO, was born at Delft, 10th April, 1583, of which town his father, John de Groot, was burgomaster, and also curator of the then newly established university of Leyden. From his boyhood Grotius manifested an extraordinary ability, and he is said to have written Latin verses when he was only eight years old. At the age of eleven he was sent to the University of Leyden, where his education was particularly superintended by the theologian Junius, with whom he lived, and by Joseph Scaliger. He remained three years at Leyden, during which he applied himself to the study of divinity, law, and mathematics. In 1597 he maintained two public theses on philosophy, and wrote in praise of Henry IV., in Latin, a poem entitled 'Triumphus Gallicus,' which he dedicated to M. de Buzenval, the French ambassador in Holland. In 1598 he accompanied a Dutch embassy to Paris, where he was introduced to the king, who gave him a golden chain and presented him to his court as the miracle of Holland. After one year's stay in France, where he was treated with much distinction by many eminent personages, he returned to Holland, whence he addressed a letter to Thuanus (De Thou), expressing his regret at having missed an opportunity of making his acquaintance when in France. This letter laid the foundation of a literary and friendly correspondence, which lasted till the death of Thuanus. In the same year (1599) he published an edition of Martianus Capella, with notes, which he dedicated to the Prince de Condé. This edition is adorned, besides a portrait of the Prince de Condé, with that of Grotius himself, aged fifteen, wearing the chain which he had received from Henry IV. Immediately on his return from France, Grotius was called to the bar, and pleaded with great success; but his legal occupations did not prevent him from attending to other studies. In the same year, 1599, he published a Latin translation of a nautical work, written by Stevinus, at the request of the Prince Maurice of Nassau, for the use of naval officers. In 1600 appeared his edition of the 'Phænomena' of Aratus. The corrections he made in the Greek text are considered to be very judicious, and his notes show some knowledge of Arabic. Notwithstanding these serious studies, Grotius found time for cultivating poetry, and with such success, that he was considered one of the best Latin poets of his time. The 'Prosopopeia' of the city of Ostend, which had sustained a siege of three years, was universally considered a masterpiece, and was translated into French by Rapin, Pasquier, and Malherbe, and into Greek by Isaac Casaubon.

Grotius was nominated advocate-general for the treasury of Holland and Zealand in 1607, and in the next year married Mary Reygersburgh, a lady of great family in Zealand. In 1613 he was made pensionary of Rotterdam, an important place which gave him a seat in the assembly of the states of Holland, and afterwards in that of the states-general, and it was about that time that he contracted an intimate friendship with Olden Barneveldt, a connection which exercised the greatest influence on his life. In 1615 Grotius was sent to England in order to arrange the difficulties arising from the claims of the English to exclude the Dutch from the whale-fisheries of Greenland. During that negotiation, Grotius was by no means satisfied with the English ministry, but he was much pleased with his reception by King James. The most agreeable incident of his visit to England was however the opportunity which it afforded him of forming an intimate friendship with Isaac Casaubon, in common with whom he entertained a hope of uniting all Christians into one church. The intimacy of Grotius with Barneveldt, whose political and religious opinions he shared, involved him in the misfortune of his friend. [BARNEVELDT; ARMINIUS.] He was condemned, on the 18th May, 1619, to perpetual imprisonment, and his property was confiscated. Pursuant to this sentence, he was conveyed, on the 6th June, in the same year, to the fortress of Loevestein, situated at the extremity of an island formed by the Maas and the Waal. His wife was allowed to share her husband's imprisonment, but Grotius's father was refused permission to see his son. During the imprisonment of Grotius study became his consolation and the business of his life. In several of his letters addressed from Loevestein to Vossius, he gives an account of his studies, informing him that he was occupied with law and moral philosophy. He devoted his Sundays to reading works on religious subjects, and he employed in the same way the time which remained after his ordinary labours were over. He wrote during his imprisonment his treatise on the truth of the Christian religion, in Dutch verse (which he subsequently translated into Latin prose), translated the 'Phœnissæ' of Euripides into Latin verse, wrote the institutions of the laws of Holland in Dutch, and drew up for his daughter Cornelia a kind of catechism in 185 questions and answers, written in Flemish verse. After eighteen months' confinement, Grotius was at last released by the ingenuity of his wife, who had obtained permission to go out of the prison twice a week.

He constantly received books, which were brought in and taken out in a large chest together with his linen. For some time this chest was strictly examined by the guards, but finding only books and foul linen, they at last grew tired of the search, and gave it up. Grotius's wife having observed this, persuaded her husband to get into the chest, which he did, and in this manner escaped from the fortress on the 21st of March, 1621. He made his way through Antwerp to France, where his wife, who had been detained for about a fortnight in prison, joined him a few months afterwards.

Louis XIII. received Grotius very favourably, and granted him a pension of 3000 livres, but it was paid with great irregularity. He was harshly treated by the Protestant ministers of Charenton, who, having assented to the doctrines of the synod of Dordrecht, refused to admit Grotius into their communion, and he was obliged to have divine service performed at home. At Paris (1622) he published his 'Apology,' which was prohibited in Holland under severe penalties. Having spent a year at Paris, he retired to a country-seat of the president De Mesmes, near Senlis, where he spent the spring and summer of 1623. It was in that retreat that he commenced his work 'De Jure Belli et Pacis,' which was published in the next year.

During his residence in France he was constantly annoyed with importunities to come over to the Roman Catholic religion; but though he was tired of the country, and received invitations from the duke of Holstein and the king of Denmark, he declined them. Gustavus Adolphus also made him offers, which, after his death, were repeated by Oxenstiern in the name of queen Christina. In the mean time the stadholder Maurice died, and his successor seeming less hostile to Grotius, he was induced by the entreaties of his Dutch friends to venture to return. He arrived at Rotterdam in September, 1631, and the news of his return excited a great sensation throughout all Holland. But in spite of all the efforts of his friends he was again obliged to leave the country, and went (in 1632) to Hamburg, where he lived till 1634, when he joined the chancellor Oxenstiern at Frankfort-on-the-Main, who appointed him councillor to the queen of Sweden, and her ambassador at the court of France. The object of the embassy was to obtain the assistance of France against the emperor. Grotius arrived at Paris in March, 1635; and although he had many difficulties to encounter from Richelieu, and afterwards from Mazarin, he maintained the rights and promoted the interests of his adopted sovereign with great firmness. He continued in his post till 1644, when he was recalled at his own request. Having obtained a passport through Holland, he embarked on his return at Dieppe, and on his landing at Amsterdam (1645) was received with great distinction and entertained at the public expense. From Amsterdam he proceeded by Hamburg and Lübeck to Stockholm, where he was received in the most flattering manner by the queen. Grotius however was not pleased with the learned flippancy of Christina's court, and resolved on quitting Sweden. The climate also did not agree with him. The queen, having in vain tried to retain him in her service, made him a present of a large sum of money, and of some costly objects; she also gave him a vessel, in which he embarked for Lübeck on the 12th August, but a violent storm, by which his ship was tossed about during three days, obliged him to land on the 17th in Pomerania, about fifteen leagues from Danzig, whence he proceeded towards Lübeck. He arrived at Rostock on the 26th, very ill from the fatigues of the journey, and from exposure to wind and rain in an open carriage; he died on the 28th August, 1645, in the sixty-third year of his age. His last moments were spent in religious preparation, and he died expressing the sentiments of a true Christian. His body was carried to Delft and deposited in the grave of his ancestors, where a monument was erected to him in 1781. Two medals were struck in honour of him.

Notwithstanding his stormy life, the works of Grotius are very numerous. They treat of divinity, jurisprudence, history, literature, and poetry. Many of them are become classical. They may be distributed as follows:—1. His 'Opera Theologica,' which were collected by his son Peter Grotius, 4 vols. 4to., Amsterdam, 1679, contain, in the first volume, his commentaries on the Holy Scriptures, but particularly on the Gospels. Leibnitz said of them (*Opera*, vol. vi., p. 226) that he preferred Grotius to all the commentators. 2. The treatise, 'De Veritate Religionis Christianæ,' which has been translated from the Latin of Grotius into many European, and even into some Oriental languages. An Arabic translation was published at Oxford, 1660, with notes by Edward Pococke. 3. A treatise in Latin 'On the Atonement,' written against Socinus, in order to vindicate the Remonstrants from the charge of Socinianism; translated into English, and published at London, 1692, under the title, 'Defence of the Catholic Faith concerning the Satisfaction of Christ,' translated by W. H. 4. 'Via ad Pacem Ecclesiasticam,' and several other treatises, amongst which the most remarkable is 'Philosophorum Sententiæ de Fato et de eo quod in nostra est Potestate.' Among his works on jurisprudence, his treatise 'De Jure Belli et Pacis' is translated into all the European languages, and has long been adopted by many universities as an elementary book for the study of international law. It seems however that the author wrote it rather for the use of sovereigns and ministers than for students. It was a favourite book of Gustavus Adolphus, and he always carried it with him. 2. 'Florum Sparsio ad Jus Justinianeum,' Paris, 1642. 3. 'Introduction to the Jurisprudence of Holland,' (in Dutch,) at the Hague, 1631. 4. 'Mare Liberum,' a treatise against the claims of the English to exclusive right over certain seas. It was answered by Selden in his 'Mare Clausum.' 5. 'De Imperio Summarum Potestatum circa Sacra,' Paris, 1646; reprinted at Naples, 1780, 'Cum Scholiis Criticis et Chronologicis.' 6. A collection of legal consultations, opinions, &c.

His principal historical works are—1. 'Annales et Historiæ Belgicæ usque ad Inducias Anni 1609, lib. xviii.;' it appeared after his death, at Amsterdam, 1657, in fol.; 2. 'De Antiquitate Reipublicæ Batavicæ,' Leyden, 1610, in 4to.; 3. 'Parallela Rerumpublicarum,' which he left in manuscript, and of which only a fragment was published in 1801, at Leyden, by Baron Meerman; 4. 'De Origine Gentium Americanarum,' Paris, 1642 and 1643, in 8vo.; 5. 'Historia Gothorum, Vandalorum, et Longobardorum,' published after his death, Amsterdam, 1655.

His Latin poems, which were collected and published for the first time by his brother William Grotius, at Leyden, in 12 vols., went through ten editions before that Amsterdam, 1670. Three tragedies—1. 'Adamus Exul,' published at Leyden, 1601, on the same subject as the 'Paradise Lost;' 2. 'Christus Patiens,' printed at Leyden, 1608, and translated into English by George Sandys, under the title of 'Christ's Passion,' with annotations, London, 1640, a translation with which the author was much pleased; the third of his tragedies is entitled 'Sophompaneas' (which signifies in Egyptian 'Saviour of the World'). The subject is the history of Joseph in Egypt. It was also translated into English by Francis Goldsmith, London, 1652. Besides these tragedies he left many poetical compositions in Latin, of the lyrical, elegiac, and epigrammatic kind, as well as many translations from the Greek poets into Latin verse. Grotius wrote some pieces of poetry in Greek, and several Dutch poems, which are much esteemed by his countrymen. His letters have gone through many editions, of which the last is that of Amsterdam, 1809. 'The Life of the truly eminent and learned Hugo Grotius,' containing a copious and circumstantial history of the several important and honorable negotiations in which he was employed, together with a critical account of his works, written originally in French by M. de Burigny, appeared at London in 1754. 'The Life of Hugo Grotius, with Brief Minutes of the Civil, Ecclesiastical, and Literary History of the Netherlands,' by Charles Butler, Esq., of Lincoln's Inn, London, 1826, is not equal to Burigny's work.

GROUND-BASE, in music, a subject consisting of very few bars, adopted as a base, and continually repeated during the whole movement, while the upper part, or parts, proceed at liberty. That the composers of the seventeenth century were proud of displaying their patience and industry by writing on subjects of this kind, we have many proofs remaining, one whereof, a chaconne by Purcell, which is equally good as an example and as a composition, is given in Dr. Crotch's *Specimens*, vol. ii., p. 91.

GROUND-GRU (*grund-eis* of the Germans, *glace-du-fond* of the French, *ground-ice* of some authors, *bottom-ice* of others), is the ice formed at the bottom of rivers.

It is generally imagined that rivers freeze only at the surface; this however is not the fact, ice being frequently formed at the bottom of running water. Thus, according to Dr. Farquharson, the phenomenon is so common, and so well known in certain parts of Lincolnshire,

that the inhabitants have given it the name of Ground-gru, a name which that gentleman has adopted in his paper on the subject in the 'Philosophical Transactions' for 1835, p. 329. Gru is the name by which the people of Lincolnshire designate snow saturated with or swimming in water; and as the ice formed at the bottom of rivers very nearly resembles that in appearance, a better name than Ground-gru could hardly be given, though it would be more precise to call it subaqueous ice, in contradistinction to that found at the surface, and because the term ground-ice, which this formation has also received, has been sometimes given to the ice occasionally met with at certain depths in the ground in northern countries.

Common however as may be the phenomenon of subaqueous ice, and although it has been noticed at various times, it has but very lately attracted the serious attention of observers. Ireland, in his 'Picturesque Views of the River Thames,' published in 1792, 2 vols. 8vo., mentions the ground-ice of that river, and on the subject quotes Dr. Plott, who says, 'The watermen frequently meet the ice-meers, or cakes of ice, in their rise, and sometimes in the underside enclosing stones and gravel brought up by them *ab imo*.'

M. Arago has published an interesting paper on the subject in the 'Annuaire du Bureau des Longitudes' for 1833, in which he mentions the following observations made on ground-ice:—In the Thames, by Hales, in 1730; in the river Drôme, department of Ardèche, France, by Desmarets, in 1780; in the Elbe, by Mons. Braun, in 1788; in the Teine, Herefordshire, by Mr. Knight, in 1816; in the Canal de la Birze, near Bâle, by Mons. Mérian, in 1823; in the Aar, at Soleure, by Mons. Hugi, in 1827 and 1829; in the Rhine, at Strasburg, by professor Fargeau, in 1829; and in the Seine, by Mons. Duhamel, in 1830. More lately still, Colonel Jackson, in a paper on the congelation of the Neva, published in the 5th volume of the 'Journal of the Royal Geographical Society,' mentions the formation of ground-gru at the bottom of that river; and in the 6th volume of the same journal there is a paper expressly on the ice formed at the bottom of the Siberian rivers. Mr. Eisdale has, in the 'Edinburgh New Philosophical Journal,' vol. xvii., p. 167, a paper on ground-ice; and, finally, Dr. Farquharson, as already mentioned, has published his observations on the ground-gru of the Don and Leochal, in Lincolnshire.

Hence it would appear that the phenomenon is by no means uncommon; perhaps it is general; though, from its very nature, little likely to attract attention, particularly in waters that are somewhat deep.

Almost all who have written on ground-gru have endeavoured to account for its formation, though no explanation yet given is perfectly satisfactory, and least of all those of Dr. Farquharson and Mr. Eisdale. The former gentleman says it is the result of radiation, and endeavours to substantiate his reasoning upon the principles of the formation of dew, seeming to forget entirely that Dr. Wells maintains expressly that wind and shade are alike obstacles to radiation; and that consequently a body of moving water so deep as to be impervious to light, and particularly when covered, as in the case of the Neva, with a sheet of ice three feet thick, and as much more of snow, must present an insurmountable obstacle to the radiation of heat from the bottom of the river. Mr. Eisdale thinks ground-ice is the result of the frozen spiculæ of the air falling into the river, and there forming *nuclei*, around which the water freezes at the bottom; but this is quite inadmissible. M. Arago's explanation in part, and the very simple fact that water, when at 32° of Fahr., if at rest, or in very slow motion (which is the case at the bottom of rivers), will freeze, seem among the most natural ways of accounting for the formation of ground-gru. M. Arago attributes the formation to three circumstances—1st, the inversion, by the motion of the current, of the hydrostatic order, by which the water at the surface cooled by the colder air, and which at all points of the temperature of water under 39° Fahr. would, in still water, continue to float on the surface, is mixed with the warmer water below; and thus the whole body of water to the bottom is cooled alike by a mechanical action of the stream; 2nd, the aptitude to the formation of crystals of ice on the stones and asperities of the bottom in the water wholly cooled to 32°, similar to the readiness with which crystals form on pointed and rough bodies in a saturated saline solution; 3rd, The existence of a less impediment to the formation of crystals in the slower motion of the water at the bottom than in the more rapid one near or at the surface. But, as has been said, no explanation yet given is quite satisfactory, and the phenomenon yet remains to be studied under all the variety of circumstances which may attend it. A knowledge of the temperature of the water at different depths is most essential to a just appreciation of the real cause of the phenomenon.

Ground-gru differs materially from surface-ice. Dr. Farquharson, in his paper, highly interesting as regards facts, describes it as having 'the aspect of the aggregated masses of snow, as they are seen floating in rivers during a heavy snow-shower; but on taking it out of the water, it is found to be of a much firmer consistence than these: it is a cavernous mass of various sized, but all small, pieces or crystals of ice, adhering together in an apparently irregular manner by their sides, or angles, or points, promiscuously the adhesion varies according to circumstances.' This corresponds precisely with what is stated by Col. Jackson to have been observed by him in the Neva at St. Petersburg. Dr. Farquharson says, that when it begins to form at the bottom, it aggregates in forms somewhat resembling little hearts of cauliflower. Mr. Weitz, author of the paper in the 'London Geographical Journal' on the ground-gru of the Siberian rivers, says that which he noticed at the bottom of the Kann (an affluent of the Jenisseï), 40 versts from Krasnojarsk, was of a greenish tinge, and resembled patches of the *confervoideæ*. From these facts we conclude that though the appearances of the ground-gru may vary with circumstances, it is in all cases essentially different from the solid compact sheets of surface-ice.

GROUNDSEL. This commonest of annual weeds is the plant called Senecio vulgaris by botanists, which was originally a native of Europe and the north of Asia, but which has followed the steps of man in his progress of colonization, till it has established itself in almost every place where there is a European settlement. It forms one species in the largest genus of plants yet known, no fewer than five hundred and ninety-five others being distinguished by M. de Candolle in his 'Prodromus.' Although in the eyes of man a worthless weed, Groundsel contributes largely to the support of small birds, which feed upon its fruit, or seeds as they are commonly but incorrectly called.

GROUSE. [Capercailzie; Tetraonidæ.]

GRUB, a name applied to the chrysalis or pupa state of insects: it is also sometimes applied to the larva state. [Pupa.]

GRUBENHAGEN, a principality in the southern part of the kingdom of Hanover, now forming a portion of the province or landrostei of Hildesheim. Its area is about 309½ square miles, and it contains three towns, nine bailiwicks, about 10,600 houses, and 74,500 inhabitants. The eastern districts, which comprehend the Harz mountains, are elevated, and not susceptible of cultivation; the highest summits are the Achtermanshöhe, 2706 feet, and the Bruchberg, 3018 feet, above the level of the sea. The western districts, though bleak, consist of spacious, open valleys, which are well cultivated. The mountains are, with very few exceptions, richly wooded: the streams are only mountain brooks. The more important rivers are the Leine, Ilm, and Hahle; and there is a small lake near Seeburg. The climate is in general bleak and variable, and the sky seldom clear. In the lowlands much corn and fruit are raised; and besides these, hops, tobacco, flax, &c., the latter especially along the banks of the Ruhme. On the whole the quantity of arable land is equivalent to 79 in every 100 acres of the surface fitted for cultivation, and of grass and pasture land about 21. Much attention is paid to the rearing of horses, and particularly horned cattle, which yield excellent butter and cheese: sheep and swine are likewise bred extensively. Wax and honey are generally made. The chief wealth of the principality however consists in its woods and forests, which are estimated to cover above one-half of its entire surface; for there are six forest intendancies, which alone contain upwards of 100 square miles of timber, of which the predominant species in the uplands is pines. The mines of the mountain districts are productive, and yield silver, copper, lead, iron, zinc, vitriol, and sulphur: the quarries produce marble, freestone, slate, alabaster, &c. Much charcoal is made. The peasantry are industrious, and spin large quantities of yarn, and make lace; linens, woollens, cottons, and metallic articles are also manufactured. The Lutheran is in the proportion of about 62 to 18 of the Roman Catholic population.

The chief towns of the principality are, Eimbeck, the capital, on the Ilm, which lies in the north, and contains about 780 houses, and 5000 inhabitants: it has two religious houses, a gymnasium, three churches, in one of which (St. Alexander's) are the sarcophagi of the dukes of Grubenhagen; an orphan asylum, two hospitals, and manufactories of woollens, cottons, linens, tobacco, leather, &c.: Osterode, in the east, a walled town, on the Söse and Apenke, with a castle, three churches, two hospitals, a gymnasium, a spacious granary, about 580 houses, and 4500 inhabitants, and manufactories of woollens, cottons, hats, deals, whitelead, tobacco, linen, stockings, &c.: and Duderstadt, in the valley of the Hahle, which flows through it, a town surrounded by ramparts laid out in walks; it has about 730 houses, and 4500 inhabitants, a Roman Catholic gymnasium, an Ursuline convent, a Lutheran and a Roman Catholic church, an orphan asylum, two hospitals, and manufactories of woollen stuffs, tobacco, tapes and ribands, brandy, &c. In the neighbourhood of Herzberg, a large village of about 450 houses and 3200 inhabitants, there are iron-works, a royal manufactory of fire-arms, and quarries of alabaster and gypsum; and near Salzderhelden and Süldek, two other villages, there are royal and private salt-works.

GRUIDÆ. [Herons.]

GRUINA'LES, a name given by Linnæus to the natural order of plants now called Geraniaceæ.

GRÜNBERG, or GRÜNEBERG, the chief town of a circle which forms part of the principality of Glogau, in the north of Prussian Silesia; it is a walled town situated on the Lunze between vine-clad hills; in 51° 57′ N. lat. and 15° 32′ E. long., on the high road from Breslau to Berlin. Grünberg has two suburbs and three gates, a Protestant and a Roman Catholic church, a town-hall, a civic school, an orphan asylum and school, an hospital, an infirmary, about 1260 houses, and a population of about 9,800. It has extensive manufactories of woollen cloths, of which about 30,000 pieces are woven annually; besides these, woollen yarns are spun, and printed linens, straw hats, leather, tobacco, &c., are manufactured. About 2000 acres of high land in the vicinity are planted with vines, from which about 10,000 hogsheads of wine are obtained, a large proportion whereof is converted into vinegar. The circle of Grünberg has an area of about 332 square miles, with five market villages, 64 other villages, and about 43,600 inhabitants; it is watered by the Oder, Ochel, &c., has fine forests of oaks and other timber, is in general fertile and well cultivated, and is well known for its woollen manufactures.

GRUS, the Crane, a constellation of the southern hemisphere, introduced by Bayer. It is situated between Eridanus and Sagittarius, a little below Piscis Australis.

Character. (None in Bayer.)	No. in Catalogue of		Magnitude.
	(Piazzi.) Lacaille C.	Astron. Soc.	
μ^1	(23)	2648	5
μ^2	(31)	2649	5
δ^1	(104)	2681	4
δ^2	(108)	2683	5
θ	(296)	2758	5
γ	(308)	2598	4
α	1781 C	2623	2
β	1823 C	2708	3
η	1827 C	2717	5
ϵ	1835 C	2721	4
ζ	1841 C	2745	5
ι	1865 C	2765	5

GRUSIA. [Georgia.]

GRUTER, JOHN, an eminent scholar and critic of the sixteenth century, was born at Antwerp, December 3, 1560. He may be esteemed half an Englishman, being of an English mother, learned and able, who is reported to have been his childhood's chief instructor. Moreover, his family being Protestant, and driven from Antwerp on account of their religion, he spent his boyhood in England, and studied several years at Cambridge, which he quitted to go to Leyden at the age of nineteen. His biography, as to dates and places, is not clearly made out. His first academic employment was at Wittemberg, as professor of history. This he left, rather than compromise his adherence to the Protestant religion. The professorship of belles-lettres at Padua, a place of much emolument, he declined on similar considerations. In 1602 we find him a professor at Heidelberg, but know not in what branch of learning: he had also the direction of the public library. He himself made a very valuable collection of books, at the expense of 12,000 crowns, which was lost in the sack of Heidelberg by Tilly in 1622. After this he received invitations from several universities, none of which were accepted. He continued to reside near Heidelberg until his death, September 20, 1627.

Gruter was more remarkable for industry than for brilliancy of talent: it is said that he published a book almost every month, which, of course, is an exaggeration; but any one of whom this could be said, must have published a great deal not worth remembering. The catalogue of his works in Niceron (v., 9) extends only to thirty-two. It includes editions of, or notes on, Seneca, Statius, Martial, Tacitus, Vell. Paterculus, Florus, Livy, Sallust, Pliny, Onosander, Panegyrici Veteres, Historiæ Augustæ Scriptores, Latini Minores, Cicero, and Publius Syrus. His chief work was 'Inscriptiones Antiquæ totius Orbis Romani,' Heidelberg, 1601: a repository of all then known inscriptions, which alone, it has been said, would be enough for the glory of Gruter. The original work however is superseded by a second edition, by Grævius, Amst., 1707, 4 vols., fol.: 'Lampas,' 6 vols. 8vo., 1602, deserves mention as a collection of rare or unpublished critical notices on all manner of subjects, by various persons, which might probably have perished in their scattered state. (Nicéron, *Mémoires pour servir*, &c., vol ix.; Bayle.)

GRUYE'RE. [Cheese, p. 14.]

GRY'LLIDÆ (*Achetidæ*, Leach), a family of insects belonging to the order *Neuroptera*. Distinguishing characters:—Thighs of posterior legs large; tibiæ armed with spines; abdomen terminated by two long and slender fleshy appendages; tarsi of the anterior and intermediate pairs of legs three-jointed; antennæ usually long and setaceous.

The three principal genera contained in this family are *Gryllus*, *Gryllotalpa*, and *Tridactylus*. In the genus *Gryllus* the anterior tarsi are simple; the labial-palpi are short; the anal appendages are long and slender, thickest at the base and pointed at the apex; the elytra in the females are studded with minute nervures which cross each other in an oblique manner; in the males the nervures are less numerous and irregularly disposed: the wings are longer than the elytra, and when not in use are folded longitudinally; the females are furnished with a long ovipositor.

The common house-cricket (*Gryllus domesticus*, Linn.) affords an example of this genus. This insect is about three-quarters of an inch in length, and of a pale brown colour, with blackish markings on the head and thorax. It is found throughout Europe, frequents houses, and prefers the vicinity of the fire. The male makes a shrill noise, which is caused by the friction of the elytra against each other. These insects are of nocturnal habits, take to the wing readily, and can leap a considerable distance. The wingless specimens are the larvæ, and those which have only rudimentary wings are the pupæ.

There is another species which is tolerably common in some parts of England and in various parts of the Continent—the field-cricket (*Gryllus Campestris*, Linn.). This insect is of a larger size than the house-cricket, and of a black colour; the inner side of the hinder thighs is red, and the elytra are brown, with a yellowish band at the base. The field-cricket generally frequents dry sandy districts; it burrows in the ground and preys upon other insects. The female is said to lay about three hundred eggs.

The species of the genus Gryllotalpa are remarkable for the large size of the anterior pair of legs and their fitness for burrowing; these legs are very broad, and flattened, notched beneath at the extremity, and bear a great resemblance to the fore feet of the mole—hence the name of mole-cricket has been applied to them. The mole-cricket (*Gryllotalpa vulgaris*, Lat.) is common in some parts of England, but appears to confine itself to particular districts. It is upwards of two inches in length and of a brown colour; the legs are yellowish. This insect excavates subterranean galleries of considerable extent, and in so doing throws up

small mounds of earth, after the manner of its prototype, among the mammalia. It is said to do much mischief in gardens and plantations by injuring the roots of plants. As yet it is doubtful whether these insects prey upon worms or other insects, or whether they feed upon roots. Latreille supposes the former to be the case. We understand that the Duke of Devonshire's grounds at Chiswick are much infested by this insect.

In Tridactylus the antennæ are short and ten-jointed; the tarsi are tree-jointed; the females have no distinct ovipositor, but the apex of the abdomen is furnished with four small appendages, of which the two upper are two-jointed. In lieu of tarsi to the posterior legs there are some small moveable hooked appendages (three in the typical species); the elytra are shorter than the abdomen, and of a triangular form; the wings exceed the elytra in length.

The small insects belonging to this genus are highly interesting, not only on account of their peculiar structure, but also in their habits. The species as yet discovered are very limited in number, and have been found only in the South of Europe and in North Africa; they invariably live near the margins of rivers, lakes, or other pieces of water, and it appears essential that the soil should be damp and consist of fine sand. In this sand they burrow, first vertically to the depth of a few inches, and then they form numerous small horizontal galleries. In the construction of these galleries they are probably in search of food. Sand is eaten and voided by these insects, and it is supposed that they receive their nutriment from the minute animalculæ left in the sand by the retiring water. For a detailed account of the habits of these insects see *Histoire Naturelle des Insectes*, by Messrs. Audouin and Brullé, tom ix., p. 192.

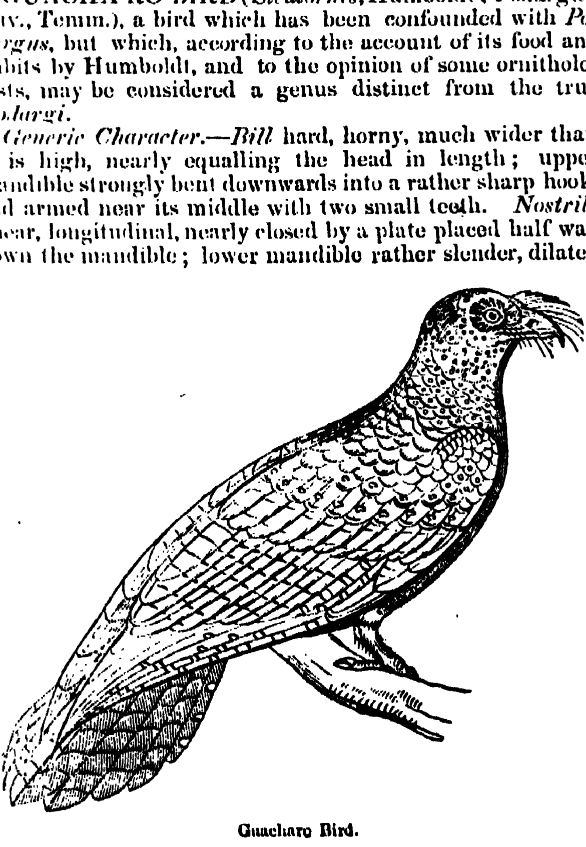
The genus Repipteryx of Mr. Newman (*Entomological Magazine*, vol. ii., p. 204) is closely allied to the last-mentioned insects. The species upon which that entomologist founded the genus is from Para in South America.

In the family Gryllidæ are also included the genera *Acanthus*, *Phalangopis*, *Platydactylus*, *Sphærium*, and *Cylindrodes*. The species upon which the last-mentioned genus is founded is figured in Griffith's Cuvier's 'Animal Kingdom—Insects,' vol, ii., pl. 131. It is remarkable for its slender and cylindrical form, but in many respects approaches the genus Gryllotalpa.

GRYPHÆA, a genus of Conchifera monomyaria (Lamk.) closely allied to the oyster, and very abundant in the secondary strata of Europe from the lias upwards to the chalk, but scarcely known in tertiary strata. [OSTRACEA.]

GUACHA'RO BIRD (*Steatornis*, Humboldt; *Podargus*, (Cuv., Temm.), a bird which has been confounded with *Podargus*, but which, according to the account of its food and habits by Humboldt, and to the opinion of some ornithologists, may be considered a genus distinct from the true *Podargi*.

Generic Character.—*Bill* hard, horny, much wider than it is high, nearly equalling the head in length; upper mandible strongly bent downwards into a rather sharp hook, and armed near its middle with two small teeth. *Nostrils* linear, longitudinal, nearly closed by a plate placed half way down the mandible; lower mandible rather slender, dilated at its base; gape considerable, and extending to the posterior part of the eye; base of the bill furnished with stiff hairs directed forwards. *Feet* short, weak, with four toes separated up to their base; *claws* arched and weak, not dentilated. Fourth *quill* longest. (Humboldt.)



Guacharo Bird.

Example, *Steatornis Caripensis*, Humb. Size of a common fowl; plumage sombre, brownish-grey, mixed with small striæ and black dots; large white heart-shaped spots bordered with black on the plumage of the head and on the wing and tail feathers. The plumage of the back is without spots. Tail wedge-shaped.

Baron Alexander de Humboldt, in his 'Personal Narrative,' gives a lively description of the locality and habits of this remarkable and useful bird, and we shall endeavour to select the chief points of his account.

The *Cueva*, or Cavern, of the *Guacharo*, and the coolness of the climate, give celebrity to the valley of Caripe. The people love the marvellous, and are never tired of discussing the subject of a cavern that gives birth to a river and is haunted by thousands of nocturnal birds, whose fat is employed in the missions for culinary purposes. The traveller on his arrival at Cumana soon hears of the stone of Araya for the eyes—of the labourer of Arenas who gave suck to his infant—and of the cavern of Guacharo, said to be several leagues in length—even to weariness. The cavern, called by the natives 'a mine of fat,' is not situated actually in the valley of Caripe, but at the distance of three short leagues from the convent, towards the west-south-west, and it opens into a lateral valley terminated by the *Sierra del Guacharo*. Humboldt and his party, accompanied by the Alcaids, or Indian magistrates, and the greater part of the monks of the convent, set out for the Sierra on the 18th of September; and they at first traversed for an hour and a half a narrow path towards the south, across a plain covered with beautiful turf. They then turned westward, tracing up a small river which issues from the cavern. The ascent continued for three-quarters of an hour, during which they went sometimes in the shallow water and sometimes between the torrent and a rocky wall, on a very miry and slippery soil. This part of the road, with its incumbrances of falling earth, scattered trunks of trees, over which the mules could hardly pass, and a profusion of creeping plants that covered the ground, was very fatiguing. When they arrived at the foot of the lofty mountain of Guacharo, they were only four hundred paces from the cavern, without yet perceiving the entrance. The torrent runs in a hollow excavated by the waters; and they went on under a ledge or cornice, the projection of which prevented them from seeing the sky. The path winds like the river, and, at the last turning, they suddenly stood before the immense opening of the cave. Humboldt, who had already been familiar with caverns, confesses that the reality far exceeded his expectations.

The *Cueva del Guacharo* is pierced in the vertical profile of a rock, and the entrance is towards the south, forming a vault eighty feet broad and seventy-two feet high, an elevation but a fifth less than that of the Louvre. The rock surmounting the cavern was covered with trees of gigantic height, and all the luxuriant profusion of an intertropical vegetation. Our space prevents an enumeration of the beautiful and curious plants, among which the *orchideæ* are not forgotten, recorded by the Baron, and dwelt on by him with a pardonable rapture; but it is worthy of observation, that this luxuriance penetrated even into the vestibule of the cave. The travellers saw with astonishment plaintain-leaved heliconias eighteen feet in height, the praga palm, and tree arums, follow the banks of the river even to the subterranean places. There the vegetation continues, as in the deep crevices of the Andes, half shut out from the light of day, nor does it disappear till a distance of thirty or forty paces from the entrance. The party went forward for about four hundred and thirty feet without being obliged to light their torches. Where the light began to fail, they heard from afar the hoarse cries of the *Guacharo birds*. These birds quit the cavern only at nightfall, especially when there is moonlight; and Humboldt remarks that it is almost the only frugivorous nocturnal bird yet known. It feeds on very hard fruits, and the Indians assured him that it does not pursue either the lamellicorn insects or those *phalænæ* which serve as food to the goatsuckers. He states that it is difficult to form an idea of the horrible noise made by thousands of these birds in the dark recesses of the cavern, whence their shrill and piercing cries strike upon the vaulted rocks and are re-

peated by the echo in the depths of the grotto. By fixing torches of copal to the end of a long pole, the Indians showed the nests of these birds fifty or sixty feet above the heads of the explorers, in funnel-shaped holes, with which the cavern-roof is pierced like a sieve.

Once a year, near midsummer, the Guacharo cavern is entered by the Indians. Armed with poles, they ransack the greater part of the nests, while the old birds hover over the heads of the robbers, as if to defend their brood, uttering horrible cries. The young which fall down are opened on the spot. The peritoneum is found loaded with fat, and a layer of the same substance reaches from the abdomen to the vent, forming a kind of cushion between the bird's legs. Humboldt here remarks that this quantity of fat in frugivorous animals, not exposed to the light and exerting but little muscular motion, brings to mind what has been long observed in the fattening of geese and oxen. It is well known, he adds, how favourable darkness and repose are to this process. At the period above mentioned, which is generally known at Caripe by the designation of 'the oil harvest,' huts are built by the Indians, with palm leaves, near the entrance and even in the very porch of the cavern. There the fat of the young birds just killed is melted in clay pots over a brushwood fire; and this fat is named butter or oil (*manteca* or *aceite*) of the Guacharo. It is half liquid, transparent, inodorous, and so pure that it will keep above a year without becoming rancid. In the kitchen of the monks of the convent of Caripe no other oil is used, and Humboldt never found that it imparted a disagreeable taste or smell to the aliments. The quantity of very pure *manteca* collected does not exceed 150 or 160 bottles, each being sixty cubic inches; the rest, which is less transparent, is preserved in large earthen vessels: the whole hardly seems to correspond with the immense annual carnage of birds.* The use of the Guacharo oil is very antient, and an Indian family, bearing the name of Morocomas, pretend to be the lawful proprietors of the cavern, as descendants from the first colonists of the valley, and lay claim to the monopoly of the fat; but, when Humboldt wrote, the monks had taken care that their rights were merely honorary. The Indians were obliged, in conformity with the system of the missionaries, to furnish oil of guacharoes sufficient for the church lamp; the rest, Humboldt was assured, was purchased from them. He observes that the race of Guacharo birds would have been extinct long since if several circumstances had not contributed to its preservation. The natives, withheld by superstitious fears, seldom dare to proceed far into the recesses of the cavern. Humboldt had great difficulty in persuading them to pass beyond the outer part of the cave, the only portion of it which they visit annually to collect the oil; and the whole authority of the *Padres* was necessary to make them penetrate as far as the spot where the floor rises abruptly at an inclination of sixty degrees, and where a small subterraneous cascade is formed by the torrent. In the minds of the Indians this cave, inhabited by nocturnal birds, is associated with mystic ideas, and they believe that in the deep recesses of the cavern the souls of their ancestors sojourn. They say that man should avoid places which are enlightened neither by the sun nor the moon; and 'to go and join the Guacharoes' means to rejoin their fathers—in short, to die. At the entrance of the cave the magicians and poisoners perform their exorcisms to conjure the chief of the evil spirits. It appears also, as another cause of preservation, that Guacharo birds inhabit neighbouring caverns too narrow to be accessible to man, and from these perhaps the great cavern is repeopled; for the missionaries declared that no sensible diminution of the birds had been observed. Young birds of this species have been sent to the port of Cumana, and have lived there several days, but without taking any food; the seeds offered to them not suiting them. The crops and gizzards of the young birds opened in the cavern contain all sorts of hard and dry fruits, which are conveyed to them by their parents: these are preserved, and, under the name of *semilla del Guacharo* (Guacharo seed), are considered a celebrated remedy against intermittent fevers, and sent to the sick at Carioco and other low localities where fever prevails. Our limits will not allow us to pursue Humboldt's description farther; and we must content ourselves with referring the reader to the 'Narrative' for many interesting details respecting the cavern itself and the surrounding scenery, giving only in conclusion, the situation, elevation and temperature of this extraordinary grotto.

The *Cueva del Guacharo*, then, is situated nearly in lat. 10° 10′, and consequently in the centre of the torrid zone. Its elevation is 506 toises above the level of the Gulf of Cariaco. Humboldt found, in the month of September, the temperature of the interior air in every part of it between 64° 6′ and 66° of Fahrenheit, and the external atmosphere 61° 2′. At the entrance, the thermometer in the air gave 63° 7′; but when it was immersed in the water of the little subterraneous river it stood, even to the end of the cave, at 62° 2′.

GUADALAVIAR. [SPAIN.]

GUADALA'JARA, a province of Spain, forming part of New Castile, is bounded on the north by the provinces of Burgos and Soria; on the east by Aragon, from which it is separated by the great central ridge which, under the name of Sierra de Molina, divides the basin of the Ebro from that of the Tagus; and on the west by the provinces of Madrid and Toledo. The province forms part of the upper basin of the Tagus, and is watered by the Henares, the Jarama, the Tajuna, and other affluents of that river. [CASTILE.] The ground towards the north and east rises into extensive and elevated table-lands, which produce good pastures and wood for fuel: the valleys along the course of the rivers produce corn, wine, hemp, flax, some oil, fruits, wax, and honey. In the mountains are abundant mines of iron. The province is divided into two districts, Siguenza and Guadalajara, containing altogether 521 pueblos, or communes, and about 215,000 inhabitants. Guadalajara, the capital of the province, is situated on the river Henares, on which there is a Roman bridge restored in 1758. It contains about 6700 inhabitants, several churches and convents, a college, an hospital, and the vast mansion or palace of the dukes del Infantado, with some good paintings, and in the convent of the Franciscans the splendid sepulchral chapel of the same family. The old royal manufactory of woollens, established at Guadalajara by Philip V., which was once very prosperous, is now in the hands of private individuals, but greatly decayed. Guadalajara is 10 leagues north-east of Madrid, on the high road to Aragon.

(Miñano, *Diccionario Geografico de España.*)

GUADALA'JARA, the capital of the republic of Xalisco, which belongs to the Mexican confederation, is situated on the banks of the river Santiago, about 21° N. lat. and 104° W. long. Though its population is stated by Humboldt to be only 19,500, it had increased to 46,804 in 1823, according to Ward, who supposes that in 1827 it amounted to nearly 60,000. It therefore ranks as the second city of the confederation. The town is handsome, the streets are airy, and many of the houses excellent. There are fourteen squares, twelve fountains, and a number of convents and churches. The cathedral is still a magnificent building, notwithstanding the destruction of the cupolas of both its towers by the great earthquake of 1818. The portales, or colonnades, may be called the bazaar of the town, being filled with handsome shops, well-stocked with European and Chinese manufactures, and with the less important produce of national industry. These portales are much better than those of Mexico, and built with equal solidity and in good taste. The Alameda, or public walk, is well laid out, and resembles in some respects an English park; it has a fountain in its centre and a stream of water all round. The inhabitants are industrious, and carry on various trades. They are good blacksmiths, carpenters, silversmiths, and are noted for their skill in working leather, as well as in manufacturing a sort of porous earthenware, with which they supply not only Mexico, but also the neighbouring states of the Pacific. Shawls of striped calico are also made in considerable quantities. The port of Gaudalajara is San Blas on the Pacific, but it has not been much visited lately, on account of its natural inferiority to Mazatlan and Guaymas, and the trade of Guadalajara with foreign countries is at present inconsiderable. (Ward; Humboldt; Hardy.)

GUADALOUPE, an island, or more correctly two islands, divided from each other by a very narrow channel, forming part of the Lesser Antilles, and intersected by 16° 20′ N. lat. and by 62° W. long. Guadaloupe was first discovered by Columbus in 1493, and was thus named by him in honour of Saint Maria de la Guadaloupe. It was previouly

* The author remarks that this branch of industry reminds one of the harvest of pigeon's oil, of which some thousands of barrels were formerly collected in Carolina from the young of the Passenger Pigeon, *Ectopistes migratoria*. [COLUMBIDÆ, vol. vii., p. 373.]

called by the native inhabitants Quéraquiera. It was not until 1635 that any settlement of Europeans was formed in the island. In that year a body of 500 Frenchmen landed, and forthwith began a war of extermination with the natives, which continued until 1640. It remained in possession of France until 1759, when it was taken by the English, but was restored to France in 1763. It was again taken by the English in 1794, and retaken in the following year. In 1810 it once more fell into the hands of the English, and was restored in 1814 at the general peace, since which time it has remained in the possession of France.

The channel which bisects Guadaloupe, and is called La Rivière Salée, or Salt River, runs from north to south, and has a large bay at each end; that on the north is called *Grand Cul-de-sac*, and that on the south *Petit Cul-de-sac*. Between these bays the channel varies in breadth from 30 to 70 yards. Its depth is so unequal that only vessels of small burthen can pass through it. The land to the east of this channel is called *Grand Terre*, while that on the west, being the part first discovered and earliest settled, is more properly called Guadaloupe. The entire length of the whole island is from 60 to 70 miles, and its greatest breadth is 25 miles.

The island is apparently of volcanic origin. About the middle of the western division, somewhat towards the south, is a high mountain called *La Souffrière*, or the Sulphur Hill, about 5500 feet above the sea. A thick black smoke rises from this mountain, mixed with sparks, which are visible at night. This volcano was in a state of much activity in 1815. It forms part of a ridge which divides the western division, extending through it in a direction north and south. Several streams rise in these mountains. The eastern division, or Grand Terre, is more level than the western side, but has no streams or springs, and the soil, being of a more sandy nature, is less fertile.

The capital of the island, St. Louis, or Point-à-Petre, stands on Grand Terre, at the south entrance of the Rivière Salée, in 16° 16′ N. lat. and 61° 36′ W. long. The harbour is sheltered and the anchorage good. The town of Basse Terre, which is in the other division of Guadaloupe, stands near its south-west point, in 15° 59′ N. lat. and 61° 47′ W. long. It is an unsheltered roadstead with indifferent anchorage, and is unsafe during the hurricane season, but from its greater proximity to the most productive part of the island it is more frequented by shipping than Point-à-Petre, and is the chief commercial station of the colony.

The population of Guadaloupe in 1834, according to an official return made to the French government, was as follows:—

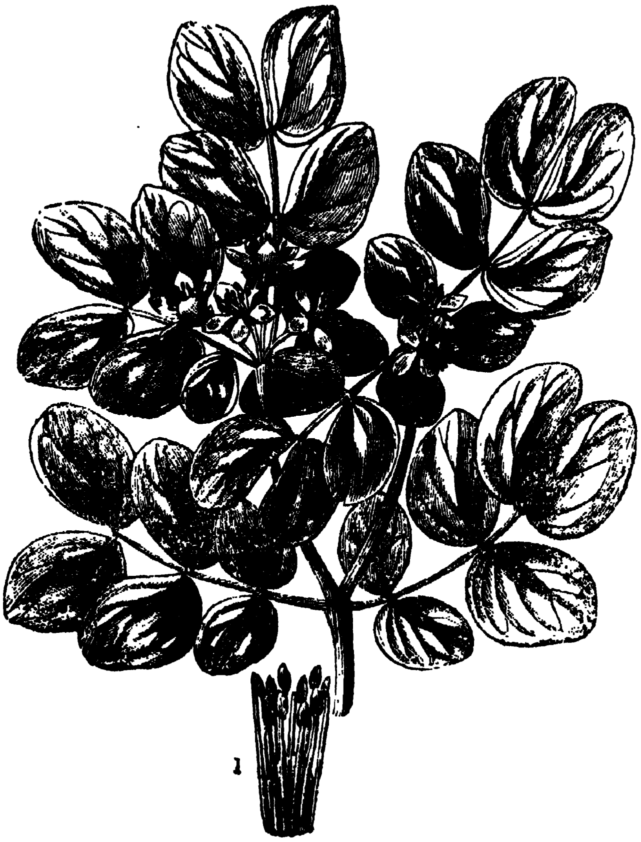
	Males.	Females.	Total.
Free Persons	13,756	14,987	28,743
Slaves	46,572	50,112	96,684
Total	60,328	65,099	125,427

The free population is divided between the towns and plantations in nearly equal proportions, while of the slaves only 12,153, or about one-eighth, reside in the towns. The number of births in 1834 was 2773, of whom 963 belonged to the free classes and 1810 to the slaves, being 1 for 16 of the free females, and only 1 for 27 of the female slaves. The number of deaths in the two classes was somewhat nearer to the proper proportions, being 887, or 1 in 32, of free persons, and 1974, or 1 in 49, of the slaves. The produce of the colony in the same year (1834) was 840,000 cwt. of sugar, 1,500,000 gallons molasses, 340,000 gallons rum, 22,500 cwt. coffee, and inconsiderable quantities of cotton and cocoa.

GUADALQUIVIR. [SPAIN.]

GUADIANA. [SPAIN.]

GUAIACUM, a genus of small crooked trees, inhabiting several of the West India islands, in low places near the sea, and belonging to the natural order Zygophyllaceæ. The most remarkable species is *G. officinale*, from which the hard, compact, black-green wood called lignum vitæ is obtained, which is so heavy that it sinks in water, and from which pestles, ship-blocks, rollers, castors, &c. are turned. This plant grows about twelve feet high, with round knotty branches. The leaves are equally pinnate, with about three pairs of opposite, smooth, roundish ovate, or obovate, oblique leaflets. The flowers are a beautiful bright blue, growing in small axillary clusters. The petals are oblong, downy in the inside, about three times as long as the sepals. There are ten stamens, and an ovate compressed ovary, which becomes an inversely heart-shaped succulent yellow capsule, with from two to five cells, and a single roundish compressed seed in each cell. This plant produces the gum-resin known in medicine under the name of Guaiacum.



Guaiacum officinale.
1, a magnified view of the stamens and ovary.

GUAIACUM OFFICINALE, a tree, native of the West Indies, of which the wood and resin are used in medicine. The wood should be procured from the duramen, or central part of the trunk, as being the richest in the active principle. This wood should be very dense, heavier than water, of an obscure greenish fawn colour; but the recent fracture is yellowish, exhibiting an unequal cleavage, with a fatty shining appearance, if the specimen be good. The wood of the circumference is lighter, both in colour and weight, pale fawn, and opake. In Guiana the wood of the Dipterix odorata (Tonka bean) is used under the name of guaiac-wood, which it greatly resembles; hence probably the statement of some writers, that the Guaiac-tree is a native of America.

Genuine guaiac-wood is destitute of smell, but if rubbed, and still more if set on fire, it evolves an agreeable aromatic odour. If long chewed, the taste is peculiar, guttural, and bitterish. Trommsdorf obtained from 100 parts 26 parts of resin of guaiac; one pound gives two ounces of extract. The active principles are the resin and a peculiar extractive. Guaiac-wood is used in the form of raspings (chiefly obtained from the shops of turners who make blocks for ships of the lignum vitæ, as they term this wood); but this is a mixture of the wood of the external and of the internal layers, of variable strength and quality. The wood is less used than the resin. Guaiac-resin exudes spontaneously, or in consequence of incisions, and hardens on the bark. Resin obtained in this way is generally in spherical or long tear-shaped pieces. It is also procured more abundantly by cutting the stem in pieces of moderate length, boring a hole through it, then putting the one end in the fire, and collecting the resin, which flows from the opposite end, in calabashes. Another mode is to boil splints of the wood in salt and water: also by digesting the rasped wood and bark in alcohol.

There are some slight differences in colour, transparency, and other points, according to the method of obtaining it; but these are of little consequence, provided no accidental or fraudulent admixture of other substances have occurred, such as pieces of wood and bark, sand, or amber. To purify it from these, it is commonly dissolved in proof spirit. By

this means a larger quantity of resin is procured than was originally subjected to the solvent, owing to a hydrate being formed. Resin which has been so purified has lost nearly all acrimony. The resin is likewise adulterated with colophony; and it is said to be adulterated with the resin or gum of the manchineel-tree, a most culpable substitution, owing to its formidable powers.

According to Unverdorben, guaiac-resin consists of two distinct resins: the one is easily soluble in aqua ammoniæ, which the alcoholic solution of acetate of copper precipitates; the other forms with ammonia a tarry combination, which is soluble in six thousand parts of water, and which the alcoholic solution of acetate of copper does not precipitate.

The resin of guaiac becomes blue by continued exposure to the air, and also when in contact with many organic substances: many vegetable substances, particularly several containing gum and starch, turn the tincture of guaiac blue; a point of importance, from the similar effect of iodine on starchy substances.

The acrid taste of guaiac-resin is owing to a peculiar bitter acrid, so-called extractive (or *guaiacin*), which is contained in much greater quantity in the bark than the wood. It is to this principle, according to Buchner, that guaiac-resin is indebted for its medicinal powers.

Guaiac possesses the property of stimulating the system generally, causing increased vascular action, augmented heat of the body, and promotes the secretions of the skin and lungs; but in large doses it produces nausea, anxiety, abdominal pains, and stupor. It is not prized now so highly as on its introduction into European practice in the sixteenth century, when it bore a most extravagant price, four ducats being often given for a pound of the wood. It is however a useful agent in certain forms and stages of gout and rheumatism, and in some cutaneous diseases, especially when in the first set of disorders it is combined with ammonia, and in the latter with mercurials and diaphoretics or antimonials.

Its insolubility in watery menstrua is an obstacle to its easy administration, and even its alcoholic solutions are precipitated on the addition of water. It is generally made into an emulsion, or given in pills; but a soap may be formed by means of heated aqua potassæ, in which the resin is to be dissolved, then evaporated, and a soft consistent mass is obtained, which may be formed into pills or a bolus.

GUAN. [Cracidæ, vol. viii., p. 130.]

GUANA'CO. [Llama.]

GUANAXUATO, the capital of Guanaxuato, one of the United States of Mexico, is situated south of 21° N. lat. and near 102° W. long. It is on the table-land of Anahuac, 6,835 feet above the level of the sea, and built on extremely uneven ground, furrowed by numerous ravines. The town, which owes its origin altogether to the mines which surround it, is very irregularly built. Many of the streets are very steep. It contains numerous splendid memorials of the former rich produce of the surrounding mines, in the magnificent palaces of the proprietors, in the church which formerly belonged to the Jesuits, in the numerous chapels and religious edifices, and in the road which leads to the mine of Valenciana. The Alhondiga, a large square building used as a public granary, is a solid edifice. Before the War of Independence, the town contained a population of 41,000, and its six suburbs nearly 30,000 more; but most of the works of the mines were destroyed during the civil war, and the annual produce, in spite of the great sums which the Anglo-Mexican Mining Association has expended for their re-establishment, still falls far short of what it was formerly. The population has consequently been reduced to less than one-half; in 1827 it consisted of 34,000, nearly all of whom were occupied in the mines, or in smelting the ores taken from them. The mines lie in different directions round the town: from 1766 to 1820, they produced not less than 225,935,736 Spanish dollars. (Humboldt; Ward.)

GUANCABELICA. [Peru.]

GUAPORE'. [Brazil, p. 359.]

GUARDIAN, one who has the care of a person and his property, who, by reason of his imbecility or want of understanding, is in law considered incapable of acting for his own interest. Guardians in the English law are appointed only to infants, though under the civil law they were also assigned to idiots, lunatics, women, and sometimes prodigals. The laws of England indeed provide for the protection of idiots and lunatics, but the rules relating to them will be more conveniently considered under those heads, and therefore we shall here confine our remarks to guardians of infants. The guardian under the civil law was either a tutor or curator. [Curator.] Guardians were appointed either by the will of the father, by the disposition of the law, or by the magistrate; and accordingly, with reference to its origin, the guardianship was styled *testamentaria*, *legitima*, or *dativa*. The nature of guardianship under the civil law is fully explained in the 'System des Pandekten-Rechts' of Thibaut, i., p. 377.

The usual division of guardians, according to the English law, and therefore the most convenient order in which to explain their office, is:—1. Guardians by the common law. 2. Guardians by custom. 3. Guardians by statute.

I. Guardians by the common law were of four kinds: guardians in chivalry, in socage, by nature, and for nurture.

Guardianship in chivalry is now abolished by the statute 12 Car. II., c. 24, which extinguished the onerous portions of the feudal system. This guardianship arose wholly out of the principles of tenure, and it could only take place where the estate vested in the infant by descent. All tenants by knights' service, being males under 21, or females under 14, at the ancestor's death, were liable to it; and it continued over males till 21, over females till 16 or marriage. It extended over the estate as well as the person of the infant, and entitled the lord to make sale of the marriage of the infant under the restriction of not making it a marriage of disparagement, and to levy forfeitures if the infant refused the marriage, or married, after tender of an alliance by the lord, against his consent. The lord was bound to maintain the infant, but subject to this obligation he was entitled to the profits of the estate for his own benefit. This guardianship being considered more an interest in the guardian, than a trust for the ward, was saleable; and if not disposed of, passed at the lord's death to his personal representatives.

2. *Guardian in Socage.*—This also, like the former, is a consequence of tenure, and takes place only where lands of socage-tenure descend upon an infant under the age of 14. Upon attaining that age, the guardianship in socage ends, and the infant may appoint his own guardian. The title to this guardianship is in such of the infant's next of blood as cannot have the estate by descent in respect of which the guardianship arises, lest, it is said, the lamb should be delivered to the wolf to be devoured. This precaution springs perhaps from too great a mistrust of human nature, and it seems that in the early period of the Roman Republic no such distinction was made. No provision upon the subject exists in the laws of the Twelve Tables—the lawgiver did not imagine that the life of the heir was in danger though it was put in the hands of the person who would reap a benefit by his death. (*Montesq.*, b. 19, c. 24.) And even at a subsequent period no such rule was known to the civil law; and indeed such a rule could have no place in the Roman system of succession. By the laws of Solon, no one could be a guardian who was to enjoy the estate of the ward after his death, and such it has been shown is the law of England with regard to guardians in socage. The laws of Scotland and the old laws of France prescribe a middle course: the estate is entrusted to the next in succession, because he is most interested in preserving it from waste, but he is excluded from the custody of the person of the ward. This is the principle upon which the Court of Chancery proceeds in its management of lunatics and their estates. [Lunacy.] The *Code Civil* of France, b 1, tit. x., ch. 1, 2, 3, has many provisions relating to guardianships, too numerous to mention here. The guardian in socage is entitled not only to the custody of the person and socage estates of the infant, but also to his hereditaments not lying in tenure, and even his copyhold estates, where no custom to the contrary exists in the manor of which they are held, and also his personal property. The guardianship in socage is regarded as a trust wholly for the infant's benefit, and is not saleable, or transmissible, but in the event of the death of the guardian the wardship devolves on the person next in degree of kindred to the infant, not being inheritable to him, and the guardian is accountable to the infant for the profits of his estate.

Guardianship in socage is however superseded both as to the person and estate of the infant, if the father appoints a guardian according to the statute, as will shortly be mentioned.

3. *Guardian by Nature.*—This species of guardianship has no connection with the rules of tenure. It extends only to the custody of the infant's person and lasts till he attains 21. Any ancestor of the infant may be such a guardian, the first right being in the father, the next in the mother, and if they be dead the ancestor to whom the infant is heir has a right to the custody of his person. Until 14, it seems the guardian in socage is entitled to the custody of the person, and after that age the guardian by nature.

4. *Guardians for Nurture*—are the father and mother of the infant; in default of father or mother, the Ordinary, it is said, may appoint some person to take care of the infant's personal estate and to provide for his maintenance and education, though this has been doubted. This species of guardianship extends only to the age of 14, in males and females. Both these last descriptions of guardianship are also superseded by the appointment of a guardian by statute.

Where an infant is without a guardian the Court of Chancery has power to appoint one, and this jurisdiction seems to have vested in the king, in his Court of Chancery, as *Parens Patriæ*, upon the abolition of the Court of Wards. [CHANCELLOR.] And where a proper case exists for the jurisdiction of this court, it will, treating all guardians as trustees for their wards, interfere not only with the property of the infant, but also with the custody of his person, and will, in case of any misbehaviour, remove a guardian, however he may have been appointed or constituted, and will appoint a proper guardian to the infant in his room. Of this jurisdiction a recent instance is afforded by the case of the Duke of Beaufort *v.* Wellesley—where, the father being alive, Lord Eldon upon moral grounds deprived him of the custody of his children—and this power of the Court of Chancery is now firmly established. And though the infant may have elected and appointed a guardian, this will not exclude the jurisdiction of the Court of Chancery, but upon the case being brought before the court it will order an inquiry as to the fitness of the guardian appointed. All courts also have power to appoint a guardian *ad litem*, that is, to defend a prosecution or suit instituted by or against an infant. (*Co. Litt.*, 88, b, Hargr. note.)

II. *Guardians by Custom.*—By the custom of the city of London the guardianship of orphans under age and unmarried belongs to the city; and in many manors particular customs exist relating to the guardianship of infants: but in the absence of any such, the like rules prevail as before mentioned of guardians in socage.

III. *Guardians by Statute.*—At common law no person could appoint a guardian, because the law appointed one in every case. The statute 4 and 5 Phil. and Mary, c. 8, seems to have given some powers to the fathers of infants to appoint guardians; but guardians by statute are now appointed by virtue of 12 Ch. II., c. 24. Under this statute fathers, whether under age or of full age, may, by deed or will attested by two witnesses, appoint any person or persons (except Popish recusants) guardians of their unmarried children until they attain twenty-one, or for any less period. A guardian appointed under this statute supersedes all other guardians, except those by the custom of London, or any city or corporate town in favour of which an exception is made, and is entitled to the custody of the infant's person, and his estate, real and personal. If two or more persons are appointed guardians under the provisions of this statute, the guardianship remains to the survivor. By the wording of the statute a *father* alone is empowered to appoint a guardian, and consequently, though the omission was probably unintentional, it has been decided that neither a mother, nor grandfather, nor any other relation, can make such an appointment. Neither can a father appoint a guardian to his natural child: but in all these cases the Court of Chancery will appoint the persons named to be guardians if they appear to be fit persons to exercise the trust reposed in them.

Guardians are rarely now appointed by infants themselves, the jurisdiction of the Court of Chancery providing far safer and more effectual means for the management and control of their property; and since in many cases the Court will interfere by petition without the institution of a suit, a cheap and speedy mode of procuring its interference is afforded. The guardian is considered as a trustee for his ward, and is accountable for the due management of the infant's property, and is answerable not only for fraud, but for negligence or omission.

Guardian of the Spiritualities is the person to whom the spiritual jurisdiction of any diocese is committed during the vacancy of the see.

Guardian of the Temporalities is he to whom the temporal jurisdiction and the profits of the see are committed during the like period.

The words guardian and warden are of the same signification: indeed, they were formerly used indifferently. Thus the warden of the Cinque Ports was styled guardian, or in the old French, gardeyn, and churchwardens, gardeyns del Eglise. The Welsh word qward is the same as the English guard.

GUARI'NI, GIOVANNI BATTISTA, was born at Ferrara in 1537, of a family which had produced several distinguished men of letters. His ancestor Guarino of Verona was one of the restorers of Greek studies in Italy. He died at Ferrara in 1460, leaving a son, Giovanni Battista Guarini, who was many years professor of belles-lettres at Ferrara, where he died in 1494, and left several works; among others a dissertation 'De Secta Epicuri,' and another, 'De Ordine docendi et studendi.' Guarini, the subject of the present article, after receiving a careful education was taken into the service of his sovereign Alfonso II., duke of Ferrara, who sent him on several missions as his ambassador to Venice, Rome, Turin, and also to Germany and Poland. In 1582 Guarini left the court of Alfonso in disgust, and retired to his villa near Rovigo, where he applied himself to his studies and to his domestic affairs, which were much impaired by the expenses attending his various journeys. After four years he was recalled by Alfonso, who appointed him secretary of state; but Guarini soon after resigned again, and passed into the service first of the duke of Savoy, and afterwards of Vincenzo Gonzaga, duke of Mantua. In 1590 he was once more recalled to Ferrara, and restored to Alfonso's favour. In 1592, Alfonso having died, and Ferrara being taken possession of by the pope, Guarini offered his services to Ferdinand de' Medici, grand-duke of Tuscany, by whom they were readily accepted; but having some time after quarrelled with him also, he passed into the court of Francesco Maria, duke of Urbino. Becoming dissatisfied here also, he left the duke of Urbino, and went to Rome, Ferrara, and lastly to Venice, where he died in October, 1612. He often complained of the trammels, jealousies, and ingratitude of courts; and yet, although he was not destitute of the means of independence, he could not live away from courts, and after repeatedly quitting in dudgeon one prince, he looked about for another to take him into his service. Guarini wrote poetry of various kinds: the most celebrated of his compositions is his 'Pastor Fido,' (the faithful swain), a pastoral drama, which was performed with great splendour at Turin on the occasion of the marriage of Charles Emmanuel, duke of Savoy, with the infanta Catharine of Spain. It was published for the first time at Venice, in 1590, ten years after the publication of Tasso's pastoral drama, the 'Aminta.' The two dramas however are very different, that of Guarini being more complicated in its plot, and more elevated in its sentiments and style; perhaps too much so for a composition called pastoral. But Guarini's shepherds are in fact men of the world and smart reasoners. The greatest charm of the poem is in the softness and fluency of its versification. It is said that the author spent many years in touching and retouching his work. It must also be observed that the 'Pastor Fido' contains some loose passages and immoral sentiments. The beauties and the faults of this production have been commented upon by a host of critics, the titles alone of whose works fill up a whole chapter of Fontanini's 'Biblioteca dell' Eloquenza Italiana,' vol. i., class 4, ch. 5. Some of these commentaries, with the name of Verrato, or Verato, in defence of his poem, were written by Guarini himself. The 'Pastor Fido' went through more than thirty editions in Italy alone; it was performed with applause in the different Italian cities, and has been translated into almost every language of Europe. Guarini wrote also a number of madrigals, and other specimens of lyric poetry His works were collected and published in 4 vols. 4to, Venice, 1737.

GUASTALLA. [PARMA.]

GUATEMA'LA till the year 1829 was the capital of that portion of the Mexican isthmus which now constitutes the United States of Central America. It was founded by the conqueror of this part of America, Pedro de Alvarado, in 1524, but not on the present site. The original city,

built about 26 miles farther west, near the town of Guatemala la Antigua, was destroyed shortly after the death of its founder (1541), as it is said, by enormous masses of water bursting forth from a neighbouring volcano, which from that circumstance has obtained the name of Vulcano de Agua, or the water-volcano. A new town was built on a neighbouring site, and is now called Guatemela la Antigua, or briefly La Antigua. This second capital was partly destroyed by earthquakes in 1773, after which disaster the present town, called Guatemala la Nueva, or the New, was founded in 1774.

Guatemala la Nueva is situated in 14° 37′ N. lat. and 90° 30′ W. long., on a plain, which is about 14 miles long and 9 wide, and is 4961 feet above the sea-level; it is 90 miles from the Atlantic and 26 miles from the Pacific Ocean. It is built with great regularity; the streets are straight, running east and west, and north and south, and cross one another at right angles. They are 40 feet wide, and always terminate in some conspicuous building. The streets are badly paved, and the surface has a considerable slope towards their middle, where it forms a gutter. The houses have only one story, but occupy a great deal of ground, containing within their walls one, two, or even three court-yards, which have a basin full of water in the middle, and are surrounded by a portico of wooden columns, under which is the entrance to the rooms: the roofs are flat. The town is well provided with water brought by an aqueduct from a spring which rises in a hill about 4 miles from the city. The aqueduct is a well-planned work, and the water is conducted by pipes into twelve public reservoirs, from which it is carried to every private house. The most remarkable buildings are round the piazza, or great market-place, a square about 150 yards each way, situated nearly in th centre of the town. On three sides of it are projecting piazzas, which form a covered walk, under which various articles are exposed to sale. On the east side stands the cathedral, a simple but noble building, and near it on one side the palace of the archbishop, and on the other the university. The north and west sides of the piazza are occupied by other public buildings, and on the south side are the best shops of the town. Besides the cathedral there are four parish churches, and fifteen other churches and chapels. All the public buildings are in a good style, and some of them judiciously decorated. Guatemala enjoys an eternal spring, the weather nearly the whole year round resembling that of the month of June in England. The thermometer rarely rises above 70°, and still more rarely descends below 64°. Earthquakes are frequent, and in 1830 several buildings of the town were damaged by one. The population, which is stated to amount to between 35,000 and 40,000, consists mostly of descendants of Spaniards, among whom there are many rather wealthy families, who spend here the rents of their estates. The commerce is limited to its own consumption and that of the neighbourhood. Its manufactures do not extend beyond the common wants of life. The suburbs, which are mostly inhabited by natives or mulattoes, here called ladinos, partly surround the town.

Guatemala la Antigua (Old Guatemala), which is about 26 miles west-south-west of the capital, is situated in a wide valley of great fertility, at the western end of which rise the two great volcanoes called De Agua and De Fuego, of which the first rises 12,620 feet above the sea, and the second still higher. The town itself is at an elevation of 5817 feet. After its partial destruction in 1773, and the foundation of New Guatemala, the Spanish government ordered the place entirely to be abandoned, and even used coercive means against those who were inclined to disobey. But as a considerable portion of the town had not suffered by the earthquake, people still returned to it, and it always contained a population of from 6000 to 8000, which in later times has so considerably increased, that it is now inhabited, according to several statements, by 16,000 or 18,000 people. This increase is mainly to be attributed to the great fertility of the valley, in which nearly all the vegetables are cultivated which are consumed in both cities; a considerable quantity of cochineal is also collected. Among the buildings which have not been destroyed is the townhall, a magnificent edifice, and a sample of the style in which the place was built. A great part of the place is still in ruins. (Juaror's *History of Guatemala*; Haefkens's *Guatemala*, and his *Central Amerika*; Dunn's *Guatemala*; and *Communication* from Colonel Galindo.)

GUAVA, or GUAIAVA. [PSIDIUM.]

GUAYAQU'IL, the capital of the department Guayaquil, in the republic of Ecuador, in South America, is situated in 2° 12′ 12″ S. lat., and 79° 39′ 46″ W. long., on the banks of the river Guayaquil, which is about two miles wide opposite the town, and enters the sea 40 miles below it, near the island of Puna. Vessels of considerable burden can sail up to the town with great ease, as the tide at full and change rises twenty-four feet. The town itself is built on the northern side of the river on a low ground, and divided into the old and new town, La Ciudad Vieja and La Ciudad Nueva. The old town, which is higher up the river, is entirely inhabited by the poorer classes. It is intersected by narrow creeks, which are full at high-water, but at half-ebb the mud is uncovered and exhales the most noisome and pestilential effluvia, especially in hot weather. The new town is exempt from this nuisance, but as it stands on a perfect level, which has no drainage, its streets during the rainy season (from December to April) are converted into quagmires, and are entirely impassable. There is also a marsh at the back of the city. All these circumstances, taken together, sufficiently account for the malignant fevers which so often prevail in Guayaquil. The whole town extends about two miles along the river, but its width is inconsiderable. The houses have commonly one story, and the framework is made of timber. The upright parts for the corners and sides are very long and stout, and are sunk four or five feet deep in the earth, as a precaution against the terrible earthquakes which are so often experienced here. In the principal street, called the Calle de Comercio, almost all the houses are two stories high; the ground-floor is divided into small shops, occupied by artisans of different trades. None of the public buildings are distinguished by architectural beauty. The custom-house is a commodious building, and has broad stone steps in front for the convenience of landing at any time of the tide, which cannot be effected anywhere else, on account of the deep mud at low-water. As the tides rise so high, the water far above the town is brackish and unfit for drinking. Several large balzas are constantly employed to bring fresh water down the river from a distant place. There are few spots, even between the tropics, which for richness and vigour of vegetation can vie with the wide valley traversed by the river of Guayaquil. Its soil consists of alluvium, and is covered with groves of every kind of intertropical fruits. A comparatively small quantity of sugar is produced, but an immense quantity of cacao, which is considered as good as that produced in Venezuela. The last article is sent to all countries bordering on the Pacific Ocean. The population of Guayaquil is stated to amount to between 24,000 and 30,000 inhabitants, mostly of Spanish origin. Many families live entirely on board of balzas in the river Guayaquil, in the same way as in China and between the numerous islands of the Indian Sea. European goods are imported into Guayaquil in considerable quantities, and sent up the river to Babayhogo or Caracol, whence they are carried on the backs of mules to the valleys of Hambato and Quito. Mount Chimborazo, as well as the volcano of Cotopaxi, are visible from the town in clear weather. (Ulloa's *Voyage to South America*; Captain B. Hall's *Journal*; *Campaigns and Cruises in Venezuela and New Granada, and in the Pacific Ocean*.)

GUAZU-BIRA. [DEER, vol. viii., p. 361.]

GUAZU-PITA. [DEER, vol. viii., p. 361.]

GUAZU-PUCO. [DEER, vol. viii., p. 361.]

GUBEN, a circle in the administrative circle of Frankfort, in the Prussian province of Brandenburg, is bounded on the north by the circle of Frankfort-on-the-Oder. Its area is about 430 square miles. The population in 1817 was 29,358; in 1831, 36,008; and is at present about 39,300. It is watered by the Oder and Neisse; the surface is undulating, mostly level; and the soil is productive in grain, flax, hemp, tobacco, &c. The only town besides Guben is Fürstenberg, which lies on the Oder near a lake, and contains a church, about 170 houses and 1750 inhabitants.

GUBEN, the chief town of the circle, in 51° 58′ N. lat., and 12° 46′ E. long., is prettily situated on the right bank of the Neisse, which becomes navigable after receiving the Lubst at this spot, and stands at the foot of the Neisse hills, which are covered with vineyards. It has three considerable suburbs, is surrounded by walls, and the principal streets are straight, broad, and well paved. The population

in 1817 was 7414, and is at present about 9040: and the number of houses nearly 1000. Guben has three churches, a gymnasium with a library, manufactories of yarns, woollens, linens, stockings, spinning-machines, leather, copperware, &c., and a brisk trade in grain, wines, fruits, &c., besides five fairs for horses and two for wool in the course of the year.

GUDGEON, a small fish common in many of the rivers and other running streams of this country, and also in most other parts of Europe. It is generally about five or six inches in length; the upper parts of the head and body are of an olive-brown colour spotted with black, and the under parts are white. The dorsal fin and the tail are brownish, and spotted with a deeper colour.

The gudgeon belongs to the family Cyprinidæ, and genus Gobio, which latter differs chiefly from the genus Barbus (the barbels) in having no strong bony ray at the commencement of either the dorsal or anal fins. Like the barbels, the gudgeons have both the dorsal and anal fins short, and are furnished with barbules, or cirri, about the mouth.

GUELDERLAND, or GELDERLAND, a province of the kingdom of Holland, lying between 51° 45′ and 52° 32′ N. lat., and between 4° 57′ and 6° 47′ E. long.; bounded on the north by the Zuider Zee and Overyssel, on the west by Utrecht and South Holland, on the south by North Brabant and Limburg, and on the east by the Rhenish provinces of Prussia. Its greatest length from north to south is 47 miles, and its greatest breadth is about the same; but its form is irregular, and the area very little exceeds 2000 square miles. The surface is in general level, but not so flat or low as the adjoining maritime provinces, and the climate is considered healthy; the soil is good and the pasturage beautiful. Guelderland is watered by the Rhine, the Waal, the Yssel, the Maas, and the Leck, besides which rivers there are several canals. The greater part of the inhabitants employ themselves in agriculture, producing the various kinds of cerealia, with buck-wheat, potatoes, hops, and tobacco. Some few manufactures are carried on; among these, paper-making and tanning are the principal: some linen is likewise produced. The province is divided politically into four districts, viz. Arnheim, Nimeguen, Thiel, and Zutphen. Guelderland was made a county in 1070, by the Emperor Henry IV.; it was raised into a duchy in 1339, by the Emperor Louis of Bavaria, and was governed by dukes of its own, who resided at Arnheim, until 1528, when it yielded to the Emperor Charles V. In 1576 it joined the league of Utrecht. In 1794 it was taken by France, and remained in possession of that country until 1814, when it became part of the kingdom of the United Netherlands.

The population in 1815 was 264,097, of whom 67,116 inhabited the towns, and 196,981 the country districts. In 1824 the population had increased to 279,226, of whom 70,510 constituted the town, and 208,716 the country population. The increase in ten years appears therefore to have been at the rate of 5¾ per cent., being little more than a half per cent. annually. The births and deaths in those ten years were—

	BIRTHS.			DEATHS.		
	Males.	Females.	Total.	Males.	Females.	Total.
Towns . .	12,549	11,849	24,398	9,233	8,535	17,768
Country .	34,088	32,376	66,464	22,324	19,726	42,050
	46,637	44,225	90,862	31,557	28,261	59,818

The number of marriages in the same years was 19,337, and of divorces 13.

The number of horned cattle in the province at the end of 1825 was 117,658; of horses there were 28,075; and of sheep, 69,071.

The capital of the province is Arnheim. [ARNHEIM.] The other principal towns are Nimeguen, Zutphen, and Harderwyk. [NYMEGEN; ZUTPHEN.] Harderwyk is a slightly-fortified port on the Zuider Zee, in 52° 22′ N. lat., and 5° 36′ E. long.: the inhabitants, about 4,000 in number, carry on the herring-fishery, and have a considerable corn-trade.

GUELDERS, a small town in the circle of Düsseldorf, in 51° 30′ N. lat. and 6° 15′ E. long., which formerly gave its name to the duchy of Guelderland, but now belongs to Prussia. It was taken by the French in 1794, and restored at the general peace in 1814. It is now an inconsiderable place, with a population of 3600. The fortifications, which once were of great strength, have been wholly demolished.

GUELPHS and GUIBELINES, the names of two great political parties which divided Italy and Germany during the middle ages, became first known as the watchwords of their respective adherents at the battle of Winsberg, in Suabia, between two rivals for the Imperial throne, Conrad, duke of Franconia, and Henry the Lion, duke of Saxony, of the house of Welf, or Wölf. Welf, who was young Henry's uncle, fought on behalf of his nephew, and his name was the war-cry of his followers; whilst those of Conrad took for their rallying word the name of Weiblingen, a town of Würtemberg, and the patrimonial seat of the Hohenstauffen family, to which Conrad belonged. [CONRAD III.] In course of time the name of Guelphs was given to all who were disaffected to the Emperor, and that of Guibelines to the supporters of the Imperial authority; and as the popes, reviving their old rivalry with the empire, encouraged and supported the disaffected Guelphs, they became at last the leaders of that party, and the Italian cities were divided between the adherents of the popes and those of the emperors. The names of Guelphs and Guibelines were not however generally adopted in Italy till the reign of Frederic II., when Italy was divided, as it were, into two camps; some cities, such as Florence, Milan, Bologna, ranging themselves on the Guelph side, while Pisa, Arezzo, Verona, and others, remained Guibeline. But in the long struggle that ensued many alternate changes took place in each city, where sometimes the Guelphs, and sometimes the Guibelines gained the upper hand. [FLORENCE: GENOA, HISTORY OF.] Most of the powerful nobles in Northern Italy, the Visconti, Doria, Della Scala, Pelavicino, were Guibelines; the Anjou dynasty, which the popes had called to the throne of Naples, were the main support of the Guelphs. As the emperors, engrossed by their German affairs, neglected and dropped their hold upon Italy, the names of Guelph and Guibeline lost their original meaning, and the struggle became one of personal or municipal ambition among the Italians themselves, the Guibelines being for the most part animated by a spirit of aristocracy, the Guelphs professing to be favourers of a popular form of government. [DANTE.] But even this distinction was often belied by facts, and the leaders of the Guelphs in some towns tyrannized over their countrymen; whilst in some instances, as at Genoa, the Guibelines formed really the popular party. In the fifteenth century the names of Guelphs and Guibelines had become a mere traditional shadow, and at last the popes themselves united with the emperor in extinguishing the independence of the Italian republics, without distinction of parties. (Sismondi, *History of the Italian Republics*; Raumer, *Geschichte der Hohenstauffen*.)

The House of Brunswick, being descended from both the houses of Este and Welf, once allied by marriage, assumes the name of Este-Guelph. [BRUNSWICK, HISTORY OF; ESTE.]

GUENONS, the French name for a group of monkeys belonging to the antient continent and its islands, the type of which may be considered to be the *Green Monkey*, *Cercocebus sabæus*, Geoff.

Mr. Gray (*Annals of Philosophy*, 1825) divides the Anthropomorphous mammalia into two families: 1. Hominidæ. 2. Sariguidæ. He characterizes the first family, *Hominidæ*, thus: 'Cutting teeth four above and below; grinders ~~ above and below; nostrils separated by a narrow septum,' and he divides the family into five subfamilies, viz.:—

† Tail none.

1. *Hominina* (Homo).
2. *Simiina* (Troglodytes, *Geoff.*; Simia, Linn.; Hylobates, *Illiger*).

†† Tail long or short.

3. *Presbytina* (Presbytes, *Esch*).
4. *Cercopithecina* (Lasiopyga, *Illig.*; Cercopithecus, *Linn.** (Gmel. ?); Cercocebus, *Geoff.*; Macacus).
5. *Cynocephalina* (Cynocephalus, *Brisson*; Papio *Brisson*).

Cuvier, in the first edition of his 'Règne Animal,' makes the *Guenons* (Cercopithecus of Erxleben, in part) which he places between the Chimpanzee and the Baboons (*Papio*),

* Linnæus, in his last edition of the 'Systema Naturæ,' (the 12th,) does not give *Cercopithecus* as a genus, but places the *Cercopitheci* under the great genus *Simia*.

consist of the following species:—*Simia Entellus*, Dufr.; *Simia rubra*, Gmel.; *Simia Æthiops*, Linn.; *Simia fuliginosa*, Geoff.; *Simia Maura*, Linn. (Gmel. ?); *Simia sabæa*, Linn.; *Simia Faunus*, Gmel.; the *Mona* (*Simia Mona* and *Simia monacha*, Schr.); *Simia Diana*, Linn.; *Simia Cephus*, Linn.; *Simia Petaurista*, Gmel.; *Simia Nictitans*, Gmel.; *Simia Nasica*, Schr. (the Proboscis Monkey, or Kahau); and *Simia nemæus*, Linn. (Gmel.?).

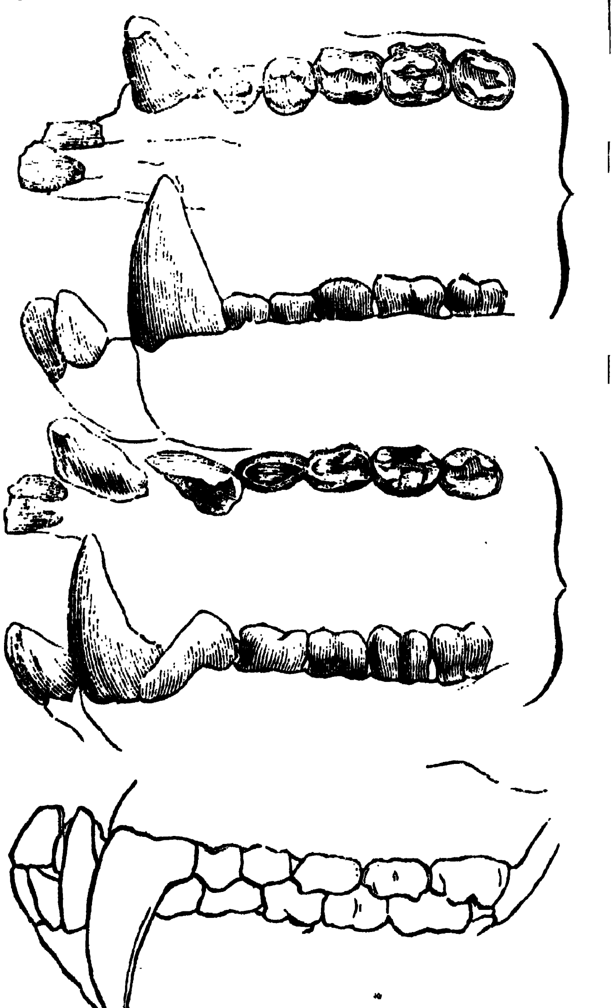
In his last edition of the same work (1829) he makes the group consist of *Simiæ rubra, Æthiops, fuliginosa, sabæa, Faunus, erythropyga, melarhina*, the *Mona, Diana, Petaurista*, and *nictitans*, and he places these *Guenons* between the *Gibbons* (*Hylobates*, Illig.) and the *Semnopitheci*. M. F. Cuvier, in his 'Histoire des Mammifères,' had expressed his doubts of the propriety of placing the *Entellus Monkey* among the Guenons, and in his work 'Des Dents des Mammifères' (1825) had separated the *Semnopitheci* from them.

Mr. Swainson ('Classification of Quadrupeds,' 1835) excludes MAN from the zoological circle, and makes the '*Quadrumana, Four-handed Quadrupeds*,' the first order of the class *Mammalia*. Of this order the '*Simiadæ*, *Apemonkeys*,' form, according to him, the first family, which consists of—1. 'Simia, Linn., *Oran-outang*,' = *Simia, Troglodytes, Hylobates, Presbytes, Pithecus*; 2. 'Cercopithecus, *Pouched Monkeys*,' = *Lasiopyga, Semnopithecus, Colobus*,* *Cercopithecus, Cercocebus, Nasalis*. The other genera are Innuus, Macacus, and Papio. In the table of of 'Typical analogical Characters,' *Cercopithecus* is placed opposite to *Feræ*.

For Mr. Ogilby's arrangement (1836) see CHEIROPODA, vol. vii.

In this article we shall confine ourselves to M. F. Cuvier's second division of the true *Guenons*.

Dental formula:—Incisors $\frac{4}{4}$, canines $\frac{1-1}{1-1}$, molars $\frac{5-5}{5-5}$ = 32.



Teeth of Guenons, one-fourth larger than nature. (F. Cuvier.)

* In the diagram of 'the Circle of Simiadæ,' in a preceding part of the book (p. 72), the word '*Colobus?*' (with a note of interrogation) appears above *Semnopithecus*, one of the five names included in the circle 'Cercopitheca'

The true Guenons comprise the genera *Cercopithecus* and *Cercocebus* of Geoffroy. Nearly similar in manners and in their dentition, particularly with regard to their canine teeth, these genera appear to be naturally allied to each other, though the facial angle and more elongated muzzle, the large cheek-pouches, and shorter tail of the second subdivision (Cercocebus) seem to lead gradually to the Baboons.

Cercopithecus.

Nearly allied to *Semnopithecus** [SEMNOPITHECUS] in form and manners, but differing from both *Semnopithecus* and *Cercocebus*, not only in the development of the dentition, but in the size of the facial angle, which ranges from 50° to 55°, in the flat nose, in the rounded head, and long posterior extremities.

Example, *Cercopithecus Mona* (*the Varied Monkey* of Pennant, *Le Singe varié* of Brisson, *La Mone* and *Guenon Mone* of Buffon and the more modern French zoologists).

Buffon is of opinion that this species is the *κῆβος* (Cebus) of Aristotle, on what ground it is difficult to imagine, for Aristotle only says—'Εστὶ δ' ὁ μὲν κῆβος, πίθηκος ἔχων οὐράν —'the Cebus is a Pithecus (or Ape) having a tail.' (*Hist.*, lib. ii., c. 8.) Pennant indeed gives '*κῆβος?*' (with an interrogation) among the synonyms of the *Varied Monkey*: but in his text he shows that he was aware upon what slender data Buffon assumed its identity with the *κῆβος* of the Greeks. Buffon refers also to Ludolf's curious account (*History of Ethiopia*) as applying to this monkey, with as much probability as distinguishes his reference to Aristotle. 'Of *Apes*,' says Ludolf, or rather his book 'made English by J. P. Gent' (1682), 'Of *Apes* there are infinite flocks up and down in the mountains themselves, a thousand and more together: there they leave no stone unturn'd. If they meet with one that two or three cannot lift, they call for more ayd, and all for the sake of the worms that lye under; a sort of dyet which they relish exceedingly. They are very greedy after *Emmets*. So that having found an emmet-hill, they presently surround it, and laying their fore-paws with the hollow downward upon the ant-heap, as fast as the emmets creep into their treacherous palmes, they lick 'em off with great comfort to their stomachs: and there they will lie till there is not an emmet left. They are also pernicious to fruit and apples, and will destroy whole fields and gardens, unless they be carefully looked after. For they are very cunning, and will never venture in till the return of their spies, which they send always before; who giving information that all things are safe, in they rush with their whole body, and make a quick dispatch. Therefore they go very quiet and silent to their prey; and if their young ones chance to make a noise, they chastise them with their fists; but if they find the coast clear, then every one hath a different noise to express his joy. Nor could there be any way to hinder them from further multiplying, but that they fall sometimes into the ruder hands of wild beasts, which they have no way to avoid but by a timely flight, or creeping into the clefts of the rocks. If they find no safety in flight, they make a virtue of necessity, stand their ground, and filling their paws full of dust or sand, fling it full in the eyes of their assailant, and then to their heels again.' Such is the account upon the strength of which Buffon makes his reference; but that is not all, for the translation at least is graced by a large plate illustrative of these wonderful scenes, and there is not the vestige of a tail among the whole party of 'Apes,' twenty-six in number.

Description.—Top of the head greenish yellow mixed with a slight tinge of black; neck, back, and sides of a deep chestnut brown, passing downwards as far as the shoulders and haunches, where it changes into a dusky slate colour continued on the limbs and tail, which last is considerably longer than the body, and has on each side of its base a remarkable white spot. Under surface of the body and inside of the limbs pure white, separated from the neighbouring colours by an abrupt line of demarcation. Naked upper part of the face, comprehending the orbits and cheeks, bluish purple. Lips, and so much of the chin as is without hair, flesh-coloured. On the sides of the face large bushy whiskers of a light straw-colour mixed with a few blackish rings advance forwards and cover a considerable portion of the cheeks. Above the eye-brows a transverse black band, extending on each side as far as the

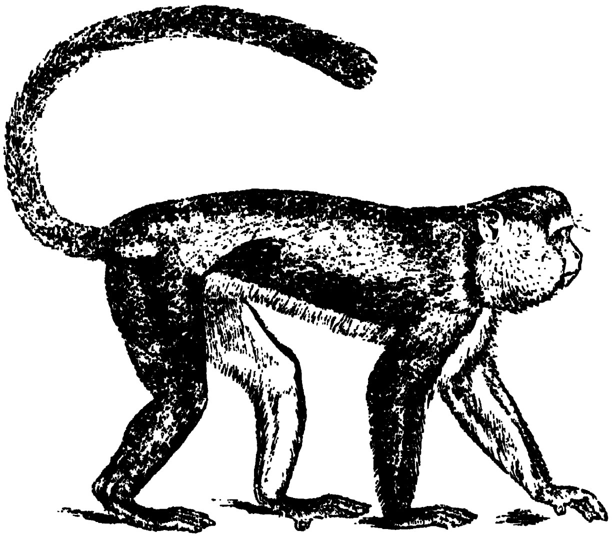
* Fossil remains of *Semnopithecus Entellus*, the Entellus Monkey, have been found in India.

ears, and surmounted by a narrow crescent-shaped stripe of grey, which is sometimes scarcely visible. Ears and hands livid flesh-colour. (Bennett, *Gardens and Menagerie of the Zoological Society of London*, vol. i.)

Mr. Bennett remarks that the name of Mona appears to be of Arabian origin, and is indiscriminately applied, under various modifications, by the Moors of Northern Africa to all the long-tailed monkeys without exception. From the language of the Moors, he observes, it has passed into those of Spain and Portugal, in both of which it has precisely the same signification. Mr. Bennett however does not agree with Pennant and Buffon, who consider it, in its Egyptian form of Monichi, to have been the origin of the English word monkey, which appears to him to admit of a much more obvious, though not very flattering derivation, from the parent-stock of our native tongue. He also expresses his doubts of the accuracy of Buffon in referring the *Cebus* of the antients to this particular species, to which, principally, on account of its being a native of the north of Africa, the latter has restricted the previously generic name of Mona.

Geographical Distribution.—Not clearly ascertained; Barbary is generally supposed to be its native place. They are brought from Africa and bear a European climate well; whence it is conjectured that they inhabit the north of Africa, or dwell in mountainous districts.

Habits.—In a state of nature not known; for Ludolf's account, to which Buffon refers, cannot, as we have endeavoured to show, be applied with any degree of certainty to this species. M. F. Cuvier gives a very entertaining account of its manners in captivity. The individual which he figures and describes from the Paris menagerie appears to have been most amiable and intelligent, and to have been distinguished for its dexterity in unlocking chests or drawers, untying knots, searching pockets, &c. The individual in the possession of the Zoological Society, from which Mr. Bennett's description was taken, was capricious, savage in temper, and altogether of a worse character.



Cercopithecus Mona. (F. Cuvier.)

Cercocebus.

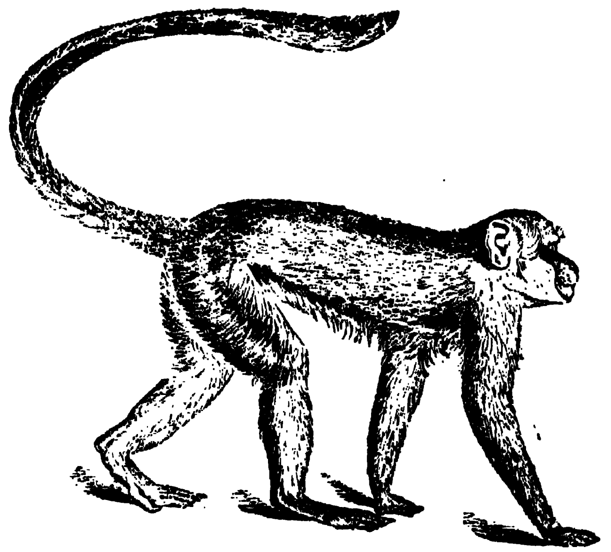
Resembling *Cercopithecus* in some points, but differing in others. Facial angle about 45°. Head inclined to the triangular form; muzzle rather lengthened; nose flat or convex; thumbs of the anterior hands slender, and placed near the fingers; those of the hinder extremities larger, and placed at a greater distince. Pygal callosities large.

Example, *Cercocebus sabæus* (*Singe vert* of Brisson; *Simia sabæa* of Linnæus; *Green Monkey* of Pennant: *St. Jago Monkey* of Edwards; *Guenon callitriche* and *Callitriche* of the French zoologists).

Description.—Greenish yellow above, arising from the ringing of the hairs with various shades of yellow and black, but assuming more of a dark grizzled appearance on the sides of the body and outer sides of the limbs, which become gradually darker towards the hands. The face, ears, and naked parts of the hands jet black, the face triangular, bounded above the eyes by a straight line of stiff black hairs, and on the sides by spreading tufts of light hairs with a yellowish tinge, meeting in a point beneath the chin. Neck and chest white; under parts of the body of a yellowish tinge; inside of the limbs grey. Length of head and body sixteen or eighteen inches; that of the tail somewhat more. (Bennett, *Gardens and Menagerie of the Zoological Society*, vol. i.)

Habits, &c.—In Adanson's 'Voyage au Senégal' will be found a good account of the habits of the species in a state of nature, and their silent and unflinching endurance of wounds and death from the gun. They associate in large troops, and are scarcely to be traced among the boughs except when they occasionally break some of them in their gambols, which are performed in silence though marked by great agility. When shot at they make no noise, but gather together in companies, knit their brows, and gnash their teeth, as if they meant to attack the enemy. In captivity their disposition in general is not amiable, and they are considered captious and malicious; but, as Mr. Bennett observes, much of their character, as in other species, depends on their age and education.

Geographical Distribution.—Africa (forests of Mauritania) and the Cape de Verd Islands. Edwards figured his specimen from an individual that was brought from St. Jago. Brisson appears to have been the first describer of the species from a specimen in the museum of Réaumur. Pennant says that it is also found in the East Indies, and that Sir Ashton Lever had his specimen from thence. Quære tamen.



Cercocebus sabæus.* (F. Cuvier.)

GUERCINO (properly GIOVANNI FRANCESO BARBIERI), was born in the year 1590, at Cento, a village near Bologna, belonging to the province of Ferrara. He gave very early proof of his talents, by painting the figure of the Virgin on the front of his father's house when he was only ten years of age. He studied under his countrymen Cremonini and Benedetto Gennari, and some accounts of him have adopted a tradition of his having been a pupil of the Carracci, but, not to mention other circumstances which render it improbable that he ever belonged to that school, it is observable that of three different manners which he successively adopted, no one bears any traces of the precepts of that celebrated academy. In his first style, which is the least known, he followed the manner of Michael Angelo da Caravaggio, with bright lights, deep shades, a yellowish tone of the flesh, producing a very powerful, but not always natural effect. His second style, which is the best and most esteemed, was formed on the results of his observation, the study of the Roman, Venetian, and Bolognese schools, by his connection with the most eminent scholars of the Carracci, and the personal friendship of Caravaggio. In this style he still retained the striking effects of light and shade, in which he followed Caravaggio, but greatly excelled him in elegance and dignity of feature, especially in his female figures; his men being, in general, little superior to the model he had before him. He established an academy at Cento in 1616, well furnished with models and antiques; to which numerous disciples soon resorted, for whose improvement he showed the greatest solicitude, and treated them with

* From this species M. F. Cuvier took the dental formula copied above.

uniform kindness and indulgence. He frequently visited the principal cities of Italy, where he met with ample employment, and as he designed and worked with great readiness and facility, his productions were very numerous. His fixed place of residence however was Cento, where he remained till the death of his friend and competitor Guido Reni, when he removed to Bologna. The general applause which the public lavished on the works of Guido induced him to adopt a third style, in which he endeavoured to attain the suavity of manner of that artist; but though he sometimes succeeded, yet on the whole his works in this third style are inferior to those of the second, being deficient in the stamp of originality, for the want of which no imitation, however successful, can compensate. He died at Bologna in 1666, in the 76th year of his age. He bore a high character for regular conduct, modesty, freedom from all petty jealousy, and generosity. He was well informed, agreeable in conversation; and died unmarried, leaving a large property to his relations. His works are at Rome, Parma, Piacenza, Modena, and Reggio, and in most of the museums and cabinets of Europe.

GUE'RET, a town in France, capital of the department of Creuse. It is between the Gartempe and the Creuse, 284 miles from Paris, through Orléans and Limoges. Guéret was the capital of the county of Marche. It is a dull place, with narrow crooked streets; but the houses are tolerably well built, and there are several fountains. There are still vestiges of its antient walls and towers. The population in 1831 was 3100 for the town, or 3921 for the whole commune. There are twelve yearly fairs for cattle, horses, hardwares, &c. The town has a subordinate court of justice, a high school, a small public library, an agricultural society, an hospital, and a theatre.

GUERICKE, OTTO. [AIR PUMP.]

GUERNSEY, one of the islands of the English Channel, belonging to England, is situated between 49° 24′ and 49° 30′ N. lat. and 2° 32′ and 2° 47′ W. long. The form of the island approximates to that of a right-angled triangle: the sides face the south, east and north-west, and are respectively about 6½, 6, and 9 miles long. The coast is somewhat difficult of approach, from the number of the rocks and the rapidity of the currents around it. The tides rise to the height of 32 feet. The northern part of the island is a level tract, and the coast for the most part lies low: the southern part is more elevated, but the high ground is intersected by narrow valleys and deep glens, and the coast is lofty and abrupt. Springs and rivulets are plentiful. The only good roads in the island are those made while Sir John Doyle was lieutenant-governor, and leading from St. Peter's Port to different parts of the island. The old roads are very bad.

The island is almost entirely of granitic formation: the rocks are chiefly gneiss, granite, granitel, and sienite. Large masses of sienite are quarried at Grande Rocque, on the north-west side of the island, for building; and at St. Sampson's, on the east side of the island, a grey or black granitel is wrought. It is used for building and paving, and large quantities of it are sent to London and Portsmouth for the latter purpose. Some trap rocks and micaceous and argillaceous schist are observable in the western part of the island.

The climate of Guernsey is subject to frequent but not great variations: the thermometer seldom rises above 80° of Fahrenheit, seldom falls as low as 37°, and never remains long stationary at the freezing point. Snow is rare, and frosts are neither severe nor durable. During the spring easterly winds generally prevail, but the prevailing winds during the rest of the year are westerly.

The soil is fertile, but the improvement of the land has been checked by the minute subdivision of property. The country people live upon and cultivate their own estates, the largest of which is said not to exceed 200 Guernsey vergees, or about 74½ English acres, and few of them exceed half that size. A man who farms 20 or 30 acres is accounted a large farmer; the holdings commonly vary from 5 to 12 acres; and the subdivision is progressively going on. The land under tillage is rapidly increasing, and wheat is the crop most generally grown, the red wheat having the preference. Oats, beans, and rye are seldom raised; oats can be imported cheaper than they can be grown. Parsnips are used for winter fodder for cattle, and for fattening them; but the cultivation of this root is declining. The ploughed lands are never suffered to lie fallow. The principal manure used is sea-weed. The horses of the island are all ill-formed and ill-fed.

The breeding of cattle, especially of cows, is in Guernsey an object of great attention. The islanders consider their cows superior to those of Jersey; and they are certainly larger. The dairy is on all farms of any size the principal object of attention, and the chief source of the farmer's profit. The butter that is made is in high repute. The export of cows to England is very small. Swine are numerous, and the hogs attain a great size; but few sheep are bred.

The island is not so well wooded as Jersey. In some parts however there is tolerable abundance of wood, and gentlemen's seats are generally shaded by trees. The hedgerows are chiefly of furze. The orchards, chiefly of apples, are productive, and a considerable quantity of cider is made, both for home consumption and for exportation. The usual fruits of an English garden grow in great abundance, and the mildness of the climate affords opportunities for raising in the open air those which in England require artificial heat or shelter. The fig-tree succeeds well: melons are raised under hand-glasses, and some species without glass; and even the orange-tree, with the advantage of a wall, and in winter the shelter of mats, bears fruit.

The cultivation of flowers is carried on with great success. The Guernsey lily, a species of the amaryllis, is a native of Japan; it is a delicate plant, liable to be injured even by the mild winters of the island, and not more than fifteen or eighteen roots in a hundred blossom.

There is a good deal of waste land in the island, especially in the western and northern parts, covered with furze, which is used for fuel. In the year 1808 a large tract of land, amounting to about 300 acres, which had been overflowed by the sea, and was covered every tide, was by the exertion of Sir John Doyle (then lieutenant-governor of the island) recovered and brought into cultivation.

A great variety of fish is taken on the shores of the island: mackerel, gar-fish, whitings, bream, pollacks, rock-fish, congers (which last sometimes weigh from 30 to 40 lbs. each), and mullets. Soles and plaice are caught, but not in any great quantity. There are crabs, lobsters, cray-fish, and oysters in plenty. There is a shell-fish, said to be peculiar to the Channel Islands, called the ormer, which, when dressed, resembles a veal cutlet. Various species of the sea anemone are found.

The only division of Guernsey is into parishes: these are ten in number, and, with their situation and population in 1831, are as follows:—St. Andrew, central, 1011; Câtel, west and central, 1937; Forest, south, 695; St. Martin, south-east, 1652; St. Peter du Bois, west and south-west, 1191; St. Sampson, north, 1109; St. Saviour, west and central, 1073; St. Torteval, south-west, 378; The Vale, north, 1410; St. Peter's Port, east, 13,893.

The aggregate population of the above parishes amounted to 24,349; and, with the population of the dependent islands, Alderney and the Caskets (1045), Serk (543), Herm (177), and Jethou (14), made a total of 26,128.

The only town in Guernsey is St. Peter's Port, situated on the slope of a hill about the middle of the eastern coast of the island, and extending for nearly a mile along the shore. What is termed Hauteville (the upper town), on the slope of the hill, to the south-west of the old town, is the most modern and best built quarter. The appearance of St. Peter's Port, on approaching it by sea, is imposing. As the houses rise one above the other, little or nothing is lost to the eye. The streets however are narrow, steep, and crooked; and the houses, though substantial, are dusky looking and old. The government-house, the residence of the lieutenant-governor, is a substantial but heavy building. Near the government-house is Elizabeth College, a handsome and extensive building, of mixed architecture and monastic appearance, surrounded with spacious ornamental grounds. St. Peter's, the most modern church in the island, was consecrated A.D. 1312. The new court-house, a neat building, and the new prison, an expensive but ill-contrived structure, are in Hauteville. The town-hospital was erected A.D. 1741-42, and enlarged and improved A.D. 1809-10. There are three markets: the fish-market, which is well supplied, is a spacious arcade, 190 feet long, and broad and lofty in proportion, with a double row of marble slabs extending the whole length of the building; the other markets are commodious. In the neighbourhood of the

markets are the public library and assembly-rooms. There is a theatre, not much better than a barn; and a promenade, called the New Ground, pleasantly laid out, but little frequented.

The harbour is formed by two piers; it is small, but is thought to be sufficient for the trade of the place. The roadstead affords a convenient anchorage, sheltered from the south-west winds, and defended by Castle Cornet, built on an insulated rock, somewhat less than half a mile from the shore, from which it is accessible at low-water in spring-tides. Fort George, a regular fortification on the heights, about half a mile south of the town, was begun A.D. 1775, and named after the then reigning sovereign George III.: it is considered to be of great strength.

During a considerable part of the wars which followed the French revolution an illicit trade with England was carried on, and the island was made the depository of wines on which the English merchants did not wish to pay duty, which was then levied immediately on exportation. The introduction however of the bonding system knocked up this latter branch of trade, for which Guernsey possessed peculiar facilities; and smuggling was put down by the strict regulations that were enforced. The chief trade at present is the carrying trade, but the amount of shipping belonging to the island does not much exceed 9000 tons.

Guernsey, like the neighbouring island of Jersey, has a political constitution of its own. The legislative body is 'the States of Deliberation,' which are composed of the bailiff of the royal court, who is speaker; the procureur or attorney of the royal court; the rectors of parishes; the constables of the parishes, one from each, who are mere delegates, voting according to the instructions given them by their constituents; and the jurats or judges of the royal court. As the benefices of the Vale and St. Sampson's are united, as well as those of Forest and Torteval, the number of the members of the states is as follows:—bailiff, 1; procureur, 1; rectors, 8; constables, 10; jurats, 12: total 32.

The bailiff and procureur are nominated by the crown; the rectors are presented by the governor; the constables and the jurats are elected by the islanders. The money required for the public expenses is voted by 'the states,' though that body cannot levy any new tax or subsidy (except on great emergencies) without the royal permission. It is then levied in a fixed proportion, according to the antient mode of assessment practised in the island. The revenue of the island is derived from the general taxes, harbour dues, publicans' and spirit retailers' licences, and other sources. The general taxes are levied for parochial as well as general purposes, and are assessed upon capital of almost every kind, including capital in the British or foreign funds, provided it belongs to an individual domiciled in Guernsey. Pensions, salaries, professional income, half pay, &c., are not taxed.

The chief court of justice in the island is the royal court, which consists of the bailiff and twelve jurats, the former appointed by the crown, the latter by the islanders. There is an appeal in certain cases to the king in council. Judicial proceedings are conducted in the language of the island. Norman customs and antient precedents form the basis of the civil jurisprudence, which is a complex mixture of Norman and English law. The power of the royal court is very extensive and undefined.

The island constitutes a deanery in the diocese of Winchester.* The livings are eight in number, two of the ten parishes being united with others. The incumbents receive only the small tithes, and the livings are very poor. The great tithes are the property of the crown, and are appropriated to the governor. The glebe-houses are kept in repair at the expense of their respective parishes. The churches are all of great antiquity, but of small pretensions to architectural beauty. The rite of confirmation is never administered; private or public instruction and examination precede the receiving of the sacrament. Dissenters and Methodists are numerous and increasing, especially the latter.

Guernsey contains a considerable number of wealthy inhabitants, and there is a greater degree of refinement than in Jersey; but also a greater spirit of exclusiveness, which has excited the notice, and, in some cases, the ridicule of visitors. The best society is, in dress, manner, and language, on a level with society of the same rank in England. Party spirit is not so violent in Guernsey as in Jersey, nor do local political squabbles engross so much attention; the topics of conversation are more varied, and there is more amenity of manner and a more perfect understanding of the English language.

The country people may be divided into three classes; the substantial land-owners and farmers, the small proprietors, and the cottagers. They are all money-seeking, and generally money-making people; but their parsimony is less extreme than that of the Jerseymen, and innovations in their manner of life are making with greater rapidity. The smaller proprietors often unite with their other pursuits the trades of carpenter or mason, or some handicraft; and walk daily six or seven miles to and from their work, yet snatch a little time for the cultivation of their land. If near the coast, they frequently unite fishing with agriculture. The cottagers are the children of the small proprietors, or day labourers. The cottages are remarkably neat and comfortable within and without. In the corner of the dwelling-room is frequently seen the 'lit de veille,' a broad bed-frame, raised a foot and a half above the ground, and covered with dry fern, or hay, or pea-haum, on which, in the evening, the young people of that and the neighbouring habitations sit in a circle, feet to feet, the girls sewing or knitting, and the young men talking or singing.

The dialect of the island, commonly considered a patois of French, is in fact the pure Norman of many centuries ago. Indeed the inhabitants of some of the parishes in the Channel Islands who have constantly intermarried are purer Normans than those of the Continent. The knowledge of English is pretty general among the upper classes.

The hospital of St. Peter's Port may be regarded as the island workhouse. The expenses of it are defrayed by voluntary contributions, by endowments, by a rate, or by the labour of the inmates, by whom various trades are followed and all the indoor work is performed; the regularity, order and cleanliness of the establishment are admirable. There are well-regulated schools for boys and girls: a chapel; and a medical department under liberal and good management. There were in this hospital, on the average of the year 1832, 79 men, 130 women, 55 boys, and 39 girls.

The principal place of education is Elizabeth College at St. Peter's Port. The education given in this institution, originally a grammar school founded by Queen Elizabeth, includes Hebrew, Greek, Latin, divinity, history, geography, French and English literature, mathematics and arithmetic: instruction in those branches is secured by a college fee of 12*l*. a year. The Spanish, Italian, and German languages, drawing and surveying, music, fencing and drilling are taught in the college by approved masters. (*Journal of Education*, No. VII.)

In each of the parishes there is a school with a small endowment. There is at St. Peter's Port a school on the Madras system, in which from two to three hundred children are instructed, besides the hospital schools already noticed. There are Sunday-schools in connection with the parish churches and the dissenting meeting-houses, supported by voluntary contributions. The church Sunday-school at St. Peter's Port contains four hundred children. Almost all the children in the island attend school, and the number of those who are unable to read and write is extremely small.

Five newspapers are published in Guernsey, two of them are in English and are published twice a week.

The Channel Islands must have been known to the Romans; but the only mention of them in any antient writer is in the Itinerary of Antoninus, and it is difficult to identify the names there given with the several islands.

In the sixth century Christianity was introduced into the Norman isles by Sampson, archbishop of St. David's, subsequently bishop of Dol in Bretagne, and by St. Magloire or Maglorius, his successor in the latter see, in the diocese of which these islands were then comprehended. The religion of the island previous to this period was Druidism, and several cromlechs and other supposed relics of that system remain in the northern part of the island.

The Channel Islands were included in the Duchy of Normandie, and are the only relics of that duchy which remain to the English crown. In the time of Edward I. the islanders stoutly repelled an attack from the French; but in the time of Edward III. Guernsey was, according to Falle, in his 'History of Jersey,' conquered by France, and recovered after they had held it three years; but the authority for this account is doubtful. It was again,

* It is incorrectly stated in the article Hampshire to be in the diocese of London.

during the reign of the same prince, attacked by the French under one Yvans, but without success. In the reign of Edward VI. the French attacked by surprise a squadron of ships lying in the roadstead of St. Peter's Port, but were repulsed.

In the civil war of Charles I. and his parliament the Channel Islands embraced the king's party, and were not subdued until after the death of Charles.

Protestantism was introduced into the islands in the reigns of Henry VIII. and Edward VI., and made considerable progress. When it was restored under Elizabeth, the Genevese discipline was gradually introduced, and at length formally established by two general synods of the clergy of all the islands held at St. Peter's Port in A.D. 1576 and 1597. That these proceedings should have received no check from the queen, as imperious in ecclesiastical as in civil matters, is a curious feature in the history of the time. Presbyterianism retained its predominance in Guernsey until the restoration of Charles II. and the passing of the Act of Uniformity. Many were then induced to fall in with the Liturgic service, but so late as A.D. 1755 the dean was obliged to apply to the civil magistrates to enforce the reading of the Litany. And even at the present time the surplice is not used, and though baptism is generally administered in the church, yet there is not a font in the whole island.

Dependencies of Guernsey, Alderney, Serk, Herm, and Jethou.—Of Alderney an account is given elsewhere. [ALDERNEY.] Serk, or Sercq, the next in size to Alderney, is about six and a half to seven miles east of Guernsey. Its greatest dimension is about three miles from north to south: its greatest breadth is about a mile and a half; but it is so contracted near the centre of the island that it may be regarded as consisting of two parts, one of them called Little Serk, connected together by a high and narrow ridge or isthmus called the Coupée. The coast is indented on every side by small bays, called by the islanders 'boutiques' (shops); and is so girt with cliffs that there is no way of landing on the island but by scrambling up the cliffs or ascending by a tunnel cut through the solid rock in the little harbour of Creux, on the north-east side of the island. Serk is a table-land, and when approached from the sea presents the appearance of an inaccessible wall of rock, from one to two hundred feet high; but when on shore it is perceived that it is broken into romantic valleys, watered by little tumbling brooks, diversified with wood, and, except Little Serk, under cultivation. Serk is a strong natural fortification, and might, at a small expense, be rendered impregnable. It is higher on the western than on the eastern side, and its western side is so abrupt that a large ship may range tolerably near without danger. The eastern shore is lined with rocks running far out into the sea.

The western side of the island belongs for the most part to the trap and schistose formation; the eastern side to the granite formation. On the west side of Serk, separated from it by a narrow strait, is the island of Brechou, or Brechnou, otherwise the Ile des Marchands, about a mile and a half round. It was once kept by the lord of Serk as a rabbit warren, but he has lately settled two families upon it.

The healthiness of Serk is attested by the fact that, on the average of ten years, the yearly mortality is not quite one in a hundred. The population in 1831 was 543. The land is generally under tillage. The manure used is vraic, or sea-weed. The produce consists of wheat, barley, oats, beans, potatoes, parsnips, and mangel-wurzel. The island grows more than sufficient for its own consumption: it is commonly said that the yearly produce of corn is equivalent to two years' consumption; in 1832 upwards of 500 qrs. of wheat were exported, and a large quantity of potatoes. From the indivisibility of property the inclosures are larger than in the neighbouring islands. There are many good orchards in Serk, which produce abundantly. The horses are not large nor good-looking, but hardy, good workers, and easily kept; horned cattle and hogs are larger than in Guernsey, and the few sheep that are kept afford excellent mutton. Disease among the cattle is rare. The quantity of land under tillage is about 1100 acres; land lets readily at 75*s.* an acre; all rents are paid in kind.

The island constitutes one manor, comprehending, besides other land, forty original copyhold farms, which cannot be divided either in case of sale or descent. This checks the increase of the population, which has consequently taken place only upon such land as had not been granted in copyhold. These copyhold farms scarcely average more than fifteen acres, and as this does not afford sufficient occupation for the farmer and his family, all the farmers are fishermen also. They catch abundance of rock-fish, which are salted for the winter: the surplus produce, consisting chiefly of crayfish and lobsters, is taken to market at Guernsey. The farmers are their own boat-builders, and the little harbour of Creux, protected by a pier or breakwater, forms the building-yard. The absence of the men at their fishing causes much out-door labour to fall upon the women, who are remarkably plain, while the men may be considered a good-looking race. The farmers' houses are built of stone, and are commonly in the dells or other sheltered situations, and the better sort have inclosures before, and a little orchard behind. The people of Serk live better than those of the neighbouring islands. Cows are very generally kept, and butter made, some of which is sent to Guernsey.

There are a few shopkeepers in Serk, and a few artificers, such as shoemakers and general carpenters; the females of each family are the tailors and hatmakers of the isle. The island, in civil, military, and ecclesiastical affairs, is a dependency of Guernsey, but a power of making local enactments is vested in the lord of the manor and the forty copyholders, who form a little parliament that meets three times in the year. The lord has a veto on its deliberations. He appoints a seneschal as the judge of the island; there is an appeal from his court to the royal court of Guernsey. All the inhabitants above sixteen years of age are obliged to bear arms, and constitute the militia of the island, about one hundred strong.

The island forms a curacy, to which the lord of Serk presents: there is no fixed stipend; but at present the lord (who receives the great tithes of the island) allows the incumbent 80*l.* a year and a free house: the church, a neat building, was built in 1820, and is regularly attended by most of the inhabitants. There is a free-school in the island, which is attended by about seventy children.

In the sixth century Serk was uninhabited, and it is said that St. Magloire, bishop of Dol, repaired here to devote himself to solitude, prayer, and meditation for his holy work, before visiting the other islands to introduce the Gospel. In the middle ages Serk was a nest of pirates, but these having been destroyed by an expedition fitted out by the men of Rye and Winchelsea, the island was again uninhabited till the time of Edward VI. Then it was occupied by the French; but was retaken by some Flemings in the reign of Mary I., Edward's successor. After this the island was uninhabited till A.D. 1565, when it was settled by a colony sent by Hillary de Carteret, Lord of St. Ouen's in Jersey, under a patent from Queen Elizabeth. Serk is called Gers by the French.

Herm is within two miles and a half of Guernsey; its greatest length is from north to south about a mile and a half, the greatest breadth scarcely exceeds half a mile. Like Guernsey it is loftiest in its southern part, where the coast is bounded by cliffs; the northern part has a low shore, with sands extending some distance beyond high-water mark. The rocks which surround it abound with shell-fish. What is called 'the shell beach' extends from half to three-quarters of a mile along the shore, and is composed of small perfect shells and fragments of larger ones, without any intermixture either of pebbles or sand. The island is rich in corals, sponges, and corallines, and affords some rare specimens of diminutive lobsters, crayfish, spider-crabs, &c. The shores afford abundance of sea-weed for manure. The island is composed of gneiss and granite, which last is quarried. It has one little harbour near the granite quarries.

Some hundreds of acres of land are under indifferent cultivation: but a good deal of land, at present covered with furze and wild mint, might be brought under tillage. The produce of the island in corn and potatoes is said to be greater than the consumption. Few sheep are kept, though there is much ground suited for them, and they were formerly more numerous. There are abundance of wild rabbits; and, besides the birds that frequent the other islands, the cormorant may sometimes be seen.

The population of the island in 1831 was 177. Herm belongs to one proprietor, who resides on the island; the granite quarries are his, and he is the only cultivator of the soil.

Jethou lies south by west of Herm, distant half a mile

from it, and two miles and a half from Guernsey: it is less than half a mile long and about a quarter of a mile broad. It is considerably elevated in proportion to its extent, and the sides are precipitous, except at one spot. It is chiefly composed of gneiss. It belongs to one proprietor, who resides on it constantly. The only land under cultivation is an orchard; the rest of the island is a rabbit warren. The population in 1831 was 14. (Inglis's *Channel Islands*; Berry's *History of Guernsey*.)

GUESCLIN, BERTRAND DU, was born in 1314, at the castle of Motte Broon, near Rennes. He was of a very strong make, but exceedingly plain; and accordingly he used to say, 'I am very ugly, and shall never please the ladies; but I shall make myself dreaded by the enemies of my king.' He could never learn to read or write, although he had a master; but he received in the house of his father that military education which was usually given to the nobles of his time. At the age of seventeen he distinguished himself at a tournament, and having immediately afterwards entered on his military career, he fought successfully in many battles and sieges against the English. By degrees he rose in rank; and after the capture of King John of France at the battle of Poictiers, he upheld by his efforts the cause of France against the formidable Black Prince, and obtained many advantages over the English. A short time after the accession of Charles V., in 1364, he gained a great victory at Cocherel over the army of the king of Navarre, for which he was rewarded with the office of marshal of Normandy, and created Count de Longueville. In the same year he was defeated by the English, and obliged to surrender to Sir John Chandos. Peace being soon afterwards concluded, Du Guesclin was liberated on the payment of a ransom of 100,000 francs. At that time a great number of soldiers who were disbanded on the conclusion of peace, as well as many nobles of various nations, united under several leaders, and oppressed the country under the name of the 'grand compagnies.' Charles commissioned Du Guesclin to rid France of this annoyance, leaving him the choice of his own means. Du Guesclin persuaded many of these adventurers who had served under his command to accompany him to Spain, in order to fight against the Saracens. He gave them 200,000 golden florins, and promised that they would meet somebody on the road who would give them an equal sum. The compagnies following him with the greatest enthusiasm, marched upon Avignon, which at that time was the papal residence. The pope had excommunicated the compagnies: they now asked for absolution and 200,000 francs. The absolution was granted, but the money was refused. The compagnies however, beginning to ravage the environs and to menace the town, obtained 100,000 francs, besides the absolution.

Du Guesclin did not lead his new troops against the Saracens, but against Peter the Cruel, king of Castile, and in support of his natural brother Henry of Transtamare. Peter was driven from his throne, and Henry established in his place. Du Guesclin was rewarded with wealth and honours by Henry, and returned to France; but Peter having obtained assistance at Bordeaux from the Black Prince, returned with a formidable army led by his ally. Du Guesclin, who hastened to the assistance of Henry, was defeated and taken prisoner. He remained for some time at Bordeaux, but a friend of his adroitly hinting to the Black Prince that some people believed that he kept Du Guesclin in prison only because he was afraid of restoring him to liberty, the chivalrous prince sent for Du Guesclin, telling him that he asked only 100 francs for his ransom, or even less, if he thought that sum too large. Du Guesclin offered 100,000 golden florins; and on the prince saying that it was too much, he declared that he would not give less than 70,000 gold florins, and that, although he was himself a poor knight, his friends the kings of Castile and France would pay that sum.

Du Guesclin again joined Henry of Transtamare against Peter the Cruel, who, in spite of the assistance given to him by the Moorish kings of Spain, was defeated and put to death, and his rival established on the throne of Castile. In 1369, when war had begun again between France and England, Du Guesclin was successful in nearly every engagement, and took from the English many places, which were reunited to France. He was afterwards employed in Bretagne with great success; but having at last met with some reverses, he was calumniated to the king, who loudly manifested his discontent. Du Guesclin felt the injury so deeply that he resigned his command, and resolved to go to Spain, in order to spend the remainder of his life with Henry of Transtamare, whom he had established on the throne of Castile. All the representations of his friends against this resolution were unavailing. His only wish, before leaving his country for ever, was to assist his friend Sancerre in the capture of the castle of Randam. He died during the siege of that place in 1380, in the 66th year of his age.

Du Guesclin is one of the most popular heroes of France, and his life has often been written. His first biography was published at Abbeville in 1487, entitled 'Le Triomphe des Neuf Preux, ou Histoire de Bertrand Du Guesclin.'

GUIANA. [GUYANA.]

GUIBELINES. [GUELPHS AND GUIBELINES.]

GUICCIARDI'NI, FRANCESCO, born at Florence, in 1482, of a noble family, distinguished himself early in the study of the law, of which science he was made professor in his native city. In 1512 he was sent by his countrymen as ambassador to Ferdinand of Aragon, whose arms had become formidable in Italy. Guicciardini appears to have fulfilled his mission in such a manner as to establish a high opinion of his diplomatic abilities. In the following year he was sent on a mission to Leo X., who, being pleased with him, took him into his service, employed him in various important affairs, and finally appointed him governor of Modena, and afterwards of Parma, both which countries were then in the possession of the pope. After the death of Leo, and the short pontificate of Adrian VI., Clement VII., who succeeded to the papal chair, retained Guicciardini in his service, and trusted implicitly to him as his chief adviser, especially on the affairs of Florence. After the surrender of that city to the imperial and papal arms, in 1530, Guicciardini, as the agent of the pope and the Medici, had a considerable share in the changes that took place in the government of the republic; and he is reproached with having advised the proscription of the popular leaders. Afterwards, he and the other adherents of the Medici resorted to the old expedient used in turns by the various factions, of calling together a parliament, or general assembly of the people, in the great square, which assembly voted the appointment of a balia, or dictatorial commission, which appointed a senate of forty-eight members [FLORENCE, *History*], which senate appointed all the subordinate magistrates, both administrative and judicial. It also established a commission of twelve, with the name of 'reformers of the state.' The members of this commission were chosen from among the adherents of the Medici, and Guicciardini was one, and the most influential of the number. The twelve began by abolishing the old authorities of the republic, the Gonfaloniere and the Priori, and proclaiming Alessandro de' Medici duke of Florence. The new duke had a foreign guard at the public palace, or town-hall, where he fixed his residence, and he began building a citadel to overawe the people. Filippo Strozzi, one of the twelve, who afterwards became the leader of the disaffected, furnished him with money to complete the work. Strozzi and others being soon disgusted at the haughtiness and licentiousness of the duke, left Florence, and went to Naples to lay their complaints before the emperor Charles V., who had been a party to the capitulation of 1530, by which the liberties of Florence were guaranteed. The Duke Alessandro also repaired thither with Guicciardini, who had remained attached to him, and when the emperor communicated to him the accusations of the refugees, and asked for his reply, the duke entrusted Guicciardini with his defence. Guicciardini's answer was sophistically though cleverly written. He contended that the changes made in the government of Florence had been effected by the parliament, or sovereign assembly of the people, according to the old practice of the republic, and at the instigation of those very refugees, Strozzi, Valori, Salviati, Ridolfi, and others, whose ambition not being satisfied, because the duke did not choose to give all his authority into their hands, made them now assume the language of popular discontent. But he slurred over the serious charges of cruelty, licentiousness, and other abuses of power, which were substantiated against the duke. The emperor, engrossed by his numerous state affairs, dismissed the Florentine question by stipulating with the duke that the refugees should have a full amnesty, and be allowed to return to Florence, and be restored to their property. He tried at the same time to

make the duke acknowledge himself his feudatory; but Guicciardini prevented this, for although hostile to a popular form of government, he was anxious to maintain the political independence of his country under a native ruler. When the Duke Alessandro was murdered by his cousin and companion in debauch Lorenzino de' Medici, in January, 1537, Guicciardini by his timely measures prevented a popular explosion, and by his influence in the council obtained the appointment of Cosmo de' Medici as governor of the Florentine republic, with a fixed income of 12,000 golden florins a-year, and under the express condition that he should do nothing without the advice of his council. Here however Guicciardini miscalculated, and he was told so at the time by his brother-councillor Vettori: he wished to establish something like the government of Genoa or Venice; but the circumstances of those states were very different from those of Florence, where the Medici had been for a century past the hereditary leaders of a powerful party, and were supported by foreign powers. The event soon undeceived Guicciardini. Cosmo, aspiring, and clever, with more self-command than his predecessor Alessandro, soon exchanged his title of governor for that of duke, and established himself as absolute lord not only of Florence, but of all Tuscany. [Cosmo I.] Guicciardini remained for some time attached to him; but finding his advice disregarded, he resigned his office, and withdrew to his country-house at Arcetri, where he employed himself in writing the contemporary history of Italy, which was not published till more than twenty years after his death. He died in his retirement, in May, 1540, at the age of 58, and his death was said to have been hastened by disappointment at the untoward result of his political exertions.

Of Guicciardini's history the first sixteen books were published in 1561; the other four appeared afterwards; and the whole twenty together were published for the first time at Venice in 1569: 'Istoria d' Italia di Francesco Guicciardini, gentiluomo Fiorentino, libri xx.' The work was afterwards frequently reprinted both in Italy and in other countries, and it has been translated into several European languages. The old Italian editions are mutilated from political motives: the first unmutilated edition was that under the fictitious date of Fribourg, 3 vols. 4to., 1775; but the most complete and correct edition is that by Professor Rosini, of Pisa, 10 vols. 8vo., 1819-20, with a luminous essay by the editor concerning Guicciardini's life and writings. Guicciardini stands by common consent at the head of the general historians of Italy. His narrative, which embraces the period from 1494 to 1532, is that of a contemporary who had seen and participated in many of the events which he relates. He is very prolix, differing in this respect from the concise nervousness of his countryman Machiavelli, and his minuteness is sometimes wearisome. He has adopted Livy's custom of putting speeches into the mouths of his principal historical personages, and sometimes the sentiments he makes them express are not consistent with facts, as Foscarini has observed in his 'History of Venetian Literature.' In his narrative he has been charged, not with stating untruths, but with colouring and disguising truth when he speaks of parties which he dislikes, such as the Florentine popular leaders, the French, and the court of Rome, which, after the death of Clement VII., became hostile to the Medici. In his tone he cannot be called either moral or patriotic. Like Machiavelli, he belongs to the school of positive or matter-of-fact historians; he considers men such as he found them to be, and not such as they might or ought to be; he relates with the same coolness an atrocious act as a generous one; and he seems to blame failure resulting from incapacity, or weakness, or scrupulousness, more than the success resulting from boldness and abilities, however unprincipled. Like some other statesmen, he considers an error in politics as worse than a crime. It must be observed however that Guicciardini lived in an age of triumphant dishonesty, that he was the contemporary of the Borgias, of Ferdinand of Aragon, of Ludovico Sforza, Bourbon, Pescara, and the worst of the Medici; and it is no wonder therefore that he ascribes the acts of public men to two great sources, selfish calculation, or passion, and seldom, if ever, to virtue, or disinterestedness. Collections have been made of the moral and political aphorisms scattered through his work, by his nephew Ludovico Guicciardini (Antwerp, 1585), by Anghiari (Venice, 1625), and others. Corbinelli published another collection of principles and sentences which it appears that Guicciardini had written separately for his own guidance: 'Consigli e Avvertimenti in materia di Re Pubblica e di Privata,' Paris, 1576. Part of his correspondence was published by Frà Remigio in his 'Considerazioni civili sopra l' Istoria di Francesco Guicciardini,' Venice, 1582. Other written during his Spanish legation, have been published by Rosini, 'Legazione di Spagna,' Pisa, 1825. Botta, a Piedmontese writer who died in 1837, has written a continuation of Guicciardini's history in 50 books: 'Storia d' Italia continuata da quella del Guicciardini sino al 1789, di Carlo Botta,' 10 vols. 8vo. This work is eloquently and cleverly written, and it has secured to its author a distinguished rank among Italian historians. Botta had previously written a history of Italy during the wars of the French revolution and of Napoleon, from 1789 to 1814. The merits of these two works are discussed in two articles of the 'Foreign Quarterly Review,' No. 1, July, 1827, and No. 33, April, 1836.

GUICOWAR. [Hindustan.]

GUIDO, D' AREZZO, who stands very prominently in all musical histories as the discoverer of the path which led to the invention of the modern system of notation, and of the true art of teaching singing, together with other improvements, was born at Arezzo, in Tuscany, towards the end of the tenth century. When young he entered the Benedictine monastery of that city, probably as a chorister, and afterwards became a monk of the order. There he first conceived a new method of writing music, and of instructing in the art; and having well digested his plan, he there also carried it into effect, at a school opened by him for the purpose. On the old system, it is stated, ten years were consumed in acquiring a knowledge of plain-song only; Guido's, we are told, reduced the years to as many months. His success excited, as commonly happens, the jealousy of his brethren, and he was driven to seek an asylum in another monastery. This we learn from his letter to Michael, a brother monk; and from the same it appears that the fame of his school having reached the ears of Pope John XIX., he was invited to Rome, and had the honour not only of explaining to the sovereign pontiff the nature of his new method, but of teaching the holy father to sing by it.

On his return from Rome he visited the abbot of Pomposa, in the duchy of Ferrara, who persuaded him to settle in that place. Here it was he wrote his *Micrologus*, or *brief discourse* on music, in which most of his inventions are described, as well as his method of instruction. But his doctrine of solmisation, or the use of the syllables *ut*, *re*, *mi*, &c., is not mentioned in that work; it is explained in a small tract under the title of *Argumentum novi Cantus inveniendi*.

To Guido we are indebted for the invention of the Staff, *i.e.* the lines and spaces; for the reformation of the Scale, as also of the mode of notation, and for the art of Solmisation. [Scale; Notation; Solmisation.] Musical instruments being, it is to be presumed, very imperfect in his day, he taught his scholars to sing by a monochord, for the proper division of which he gives precise rules: but his reliance was on a system of hexachords, or scales of six notes, which he substituted for the antient tetrachords, and on the syllables he applied to the different sounds. To this invention —an explanation of which will be found under the heads Hexachord and Solmisation—Guido is mainly indebted for the fame he has so long enjoyed. The art of counterpoint, and other important discoveries made before and after his time, have been attributed to him, but the assertions which have assigned to the ingenious ecclesiastic that to which he has no title, and never claimed, have been refuted in the most unanswerable manner.

GUIDO RENI (whom we place here as being, like Raphael, more generally known by his Christian name) was born at Bologna in 1574, where he studied painting, first under Denis Calvart, a Flemish artist of high reputation, and afterwards visited the school of the Caracci, who are reputed to have been jealous of him. He appears to have been some time undecided with respect to the style he should adopt. At first, as might be expected, he followed the Caracci, preferring however the manner of Lodovico. On visiting Rome he carefully examined every thing worthy the attention of an artist, and was enraptured with the works of Raphael. He was also much struck with the great effect of the style of Caravaggio, which he attempted for a time, but happily laid it aside for that style peculiarly

his own, in which the felicitous combination of grace, ease, grandeur, and elegance, with the highest perfection in the mechanical parts, lightness of pencil, freedom of touch, and exquisite delicacy, obtained him the universal applause of his contemporaries, and have secured him the lasting admiration of posterity. His genius was not indeed equally adapted to all subjects. He preferred, and excelled in those in which tenderness, pathos, or devotion predominate; and in these he is distinguished from all other painters. He had a peculiar manner of painting the eyes large, the mouth small, the nostrils compressed, and the toes rather too closely joined. His heads are considered by many as equal to those of Raphael in correctness of design and propriety of expression. His standard of female beauty was founded on the antique, the Venus de' Medici and the Daughters of Niobe, and hence perhaps has arisen a certain monotony. He finished his pictures with great care; his colouring is extremely clear and pure, but, sometimes, especially in his later pictures, there is a greyish cast which changed into a lurid colour. It is much to be lamented that an incurable propensity to gambling reduced him to distressed circumstances, so that his necessities compelling him to work for immediate subsistance without due regard to his honour and his fame, many of his later performances are much inferior to those which he painted in his happier days. His works have always and justly been admired all over Europe, and continue to rise in estimation and value. Among his most celebrated works were, an altarpiece in the church of St. Philip Neri at Fano, representing Christ delivering the keys to St. Peter; a St. John in the Archiepiscopal Gallery at Milan; the Virgin and Child and St. John, in the Tanaro Palace at Bologna; and the Penitence of St. Peter after denying Christ, with one of the Apostles comforting him, in the Zampieri Palace, one of his most excellent works. He died in 1642, aged 68.

GUIGNES, JOSEPH DE, born in 1721, at Pontoise, studied the Oriental languages under Stephen Fourmont. In 1745 he was nominated Oriental interpreter to the royal library in the place of Fourmont, and in 1752 was chosen a member of the Académie des Belles Lettres. The French Revolution reduced him to great destitution, but he supported his misfortune with perfect equanimity, and refused to accept any assistance. He died at Paris in 1800.

His 'Histoire Générale des Huns, des Turcs, des Mogols, et des autres Tartares Occidentaux,' Paris, 1756-58, 5 vols. in 4to., is written with great industry, and founded upon Oriental authorities, many of which had not been made use of before; but the work is considered defective in point of criticism and style. He has however the undoubted merit of being the first writer who attempted to compare the accounts of Western authors with those of China. He was the first who also attempted to discover the origin of the Huns, Turks, Avars, and other barbarous nations, and to trace out the road by which they reached the west of Asia and Europe. The other principal works of De Guignes are: 28 memoirs inserted in the collection of the Memoirs of the *Académie des Inscriptions*. The most important of them are: 'Mémoires sur quelques Evénemens qui concernent l'Histoire des Rois Grecs de la Bactriane;' 'Sur quelques Peuples qui ont envahi l'Empire Romain;' 'Sur les Liaisons et le Commerce des Romains avec les Tartares et les Chinois.' Many of his memoirs are designed to prove the Egyptian origin of the Chinese. Of these the principal is entitled, 'Mémoire dans lequel après avoir examiné l'Origine des Lettres Phéniciennes et Hebraiques, on essaie d'établir que le caractère épistolique, hiéroglyphique, et symbolique des Egyptiens se retrouvent dans les caractères Chinois, et que la nation Chinoise est une colonie Egyptienne.' The 'Mémoire sur le Commerce des François dans le Levant avant les Croisades,' is one of considerable value. De Guignes wrote many able papers for the 'Journal des Savans,' of which he was one of the most active editors for 35 years. He left in manuscript, 1. 'Diverses Notices des Auteurs Arabes;' 2. 'Mémoire sur le Commerce des Chinois avec les Russes;' 3. 'Histoire de la Chine,' compiled from Chinese authors; 4. 'Mémoires Historiques et Géographiques sur l'Afrique d'après les Auteurs Arabes.' He also edited, 1. the translation of 'Choo-King,' 1770, by Gaubil, which he revised and corrected according to the Chinese text, and enriched with very valuable notes; 2. 'Eloge de la Ville Moukden, Poeme Chinois, composé par l'Empereur Kienlong,' 1770, and 'L'Art Militaire des Chinois,' 1771, both translated by le Père Amiot. [AMIOT.]

GUILDFORD. [SURREY.]

GUILDS. [BOROUGHS OF ENGLAND AND WALES.]

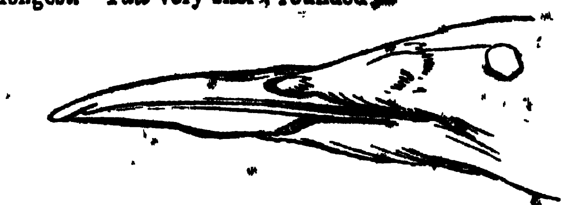
GUILLEMOTS (*Uria* of Brisson, Temminck, and authors generally), a genus of sea-birds which some ornithologists place among the family of *Divers*, or *Colymbidæ*. Linnæus places the species *Grylle* and *Troile* at the head of his genus *Colymbus*. Cuvier arranges the genus under his family *Plongeurs*, or *Brachyptères*. C. Bonaparte (Prince of Musignano) arranges them in the second section of his family *Pygopodes*, the genus *Colymbus* forming the first section. Lesson makes them belong to the family *Alcadæ*, which he seems to consider as synonymous with the *Plongeurs* of Cuvier.

Mr. Vigors on leaving the *Colymbidæ* enters the family of *Alcadæ* by means of the genus *Uria* (Briss.), which was originally included in the *Colymbus* of Linnæus, and from which, he observes, it has been separated chiefly on account of the tridactyle conformation of its foot. This character distinguishes the greater part of Mr. Vigors's group of *Alcadæ*, which, in addition to *Uria*, contains the genera *Alca* [AUK] and *Aptenodytes* [PENGUIN] of Linnæus. The latter genus, Mr. Vigors remarks, apparently carries to the extreme the typical character of those groups in which the wings, becoming gradually shorter, and less furnished with feathers, lose at length all their powers of flight, and assume the functions of fins, instead of wings, to assist the bird in its progress through the water. The whole of the family, united by the form of the foot, is separated into generic groups by the different shape of the bill. 'And here,' continues Mr. Vigors, 'a beautifully progressive series of affinities is apparent throughout the whole group. Beginning from the true *Aptenodytes*, we may observe that the bill of that genus is long, rather slender, and somewhat curved; while that of *Catarrhactes* (Briss.), which succeeds, is shorter and more elevated at the ridge; thus leading the way to *Spheniscus* (Briss.), where the sides are compressed, and the culmen elevated into a sharp edge. This structure approaches the form of the same member in the true *Alca* [AUK, vol. iii., p. 99], in which the sides are still more strongly compressed, and the culmen more elevated. The *Fratercula* (Briss.), the well-known *Puffin* of our rocky coasts [AUK, vol. iii., pp. 99-100], following *Alca*, exhibits the extreme of this singular construction; and there cannot be a more interesting subject of contemplation to him who may wish to witness the mode in which Nature harmonizes her groups, than the gradual change of form that unites the short and elevated bill of this last genus with the long and slender bill of *Aptenodytes*. A similar gradation of affinities between conterminous groups leads us back again to the point from whence we started. Some species of the Linnæan *Alca*, which M. Temminck has united under the generic title of *Phaleris* [AUK, vol. iii., p. 100], with bills less elevated at the culmen, and more tapering than that of *Fratercula*, lead us gradually to the *Mergulus* of Ray, the *little Auk* of our cabinets. [AUK, vol. iii., p. 100.] This genus, strongly and distinctively separated both from *Alca* and *Uria*, in the former of which groups it has been placed by Linnæus, and in the latter by M. Temminck, may be considered as intermediate between them. It thus brings us to *Uria*, where the pointed and tapering bill, again discernible, reconducts us to *Aptenodytes*.' (*Linn. Trans.*, vol. xiv.)

Mr. Swainson, in the first part of the second volume of the 'Classification of Birds,' appears to differ from Mr. Vigors, for he arranges the *Guillemots*, together with the *Divers* and *Grebes*, under the *Colymbidæ*. The *Alcidæ* (Alcadæ) include, according to the same author, the *Penguins* and the *Puffins*, and 'all those singularly constructed groups where the wings are abortive, or, in other words, assume more the appearance, as they perform the office, of fins;' but he remarks that the natural series of the genera have been commenced by some with *Uria;* by others, with some of the *Alcæ*, or *Puffins*. In the 'Synopsis' however, at the end of the volume, we find *Uria* the first genus of the 'Family Alcadæ: *Auks*,' with the observation that the individuals in this group are so few that the author has not considered it expedient to adopt the subgenera, particularly as their natural series has not been marked out. The genera which Mr. Swainson here places under the family *Alcadæ* are—*Uria*, Briss.; *Alca*, Linn.; *Mormon*, Ill.; *Chimerina*, Esch.; *Phaleris*, Temm.; *Aptenodytes*, Forst.

Generic Character.—*Bill* moderate, robust, straight, acute and compressed; upper mandible slightly curved towards

the point; the lower mandible forming an angle more or less open. *Nostrils* basal, lateral, concave, longitudinal, pervious, half shut by a large membrane covered with feathers advancing on the bill. *Feet* short, plunged as it were in the abdomen, so that the lower end of the tibia only is perceptible, and placed beyond the equilibrium of the body very far back; tarsi short, slender; three *toes* only, all anterior and entirely webbed; *Nails* compressed, rather curved and sharp. *Wings* short, narrow, and acute, the first *quill* longest. *Tail* very short, rounded.



Bill of Guillemot. (Uria Troile.)

Foot of Guillemot. (Uria Troile.)

Geographical Distribution and Habits of the genus.—The *Guillemots* seem especially framed for existence in the Arctic and even Polar regions, and are seldom, comparatively, found in the warmer latitudes. In the north they swarm on all the rocks and islets of the chilling seas. In the short but bright summer that gilds some of their northern haunts, they make haste to deposit their eggs, sometimes only one, on the bare rock, without wasting the precious days in making a nest. On the naked ledge that overhangs the sea the young Guillemot is hatched, and, as soon as it is able to bear the shock, is conducted, or rather tumbles, from its hard nursery into the bosom of the ocean, where a plentiful harvest is spread for it. Here the Guillemots are indeed in their element; plying their way with wings and feet beneath the waves and even beneath the ice, they make prey of the small fish and crustaceans which form their principal food. Their native rocks or the ice-caverns shelter them from the storm, and it is only when the winter is more than hyperboreally severe that some of these species are driven to a temporary resort to more temperate climates. Their flight is sharp and rapid, though of no long duration, and generally directed just above the surface of the sea. The eggs, which are reckoned palatable, notwithstanding their fishy diet, are thick in the shell, which has a dull appearance.

Dr. Richardson notices *Uria (Mergulus) Alle* [AUK, vol. iii., p. 100] among the species which merely winter in Pennsylvania, and migrate in summer to rear their young in the fur countries—*Uriæ Brunnichii, Grylle,* and *Alle,* in his list of birds detected in the North Georgian Islands and adjoining seas, lat. 73° to 75° north, on Sir Edward Parry's first voyage—and *Uriæ Brunnichii, Troile, Grylle,* and *Alle,* in the list of species common to the Old World and to the Fur countries. *Uriæ Alle, Brunnichii,* and *Grylle,* occur in the list of Greenland Birds (Captn., now Col., Sabine).

In the table published by Dr. Richardson in 'Fauna Boreali-Americana,' the following interesting information is given:—

Species.	Extreme Northern range. Distribution in the Fur-countries. Whether resident or migratory.	Species observed on the Saskatchewan, lat. 53° to 54° N., and from 600 to 1000 miles distant from the sea-coast.	Species that frequent the vicinity of Philadelphia. (C. Bonaparte.)	Winter Quarters of the Species.
Uria Troile	Lat. N. 61°. Arctic Sea and Hudson's Bay.	. . . .	Accidental visiter.	Principally at sea, in high latitudes.
—— Brunnichii	75°. Ditto. Ditto.	. . . .	Ditto.	Ditto. Ditto.
—— Grylle	75°. Ditto. Ditto.	. . . .	Ditto.	Ditto. Ditto.
—— Alle	75°. Ditto. Ditto.	. . . .	Winter. Rather rare.	United States.

Captain James Ross ('Supplement to Sir John Ross's last Voyage') says, that *Uria Brunnichii* abounds in Baffin's Bay and is found in most parts of the Arctic Seas, and that he has also met with the species at Uist, the northernmost of the Shetland Islands, and in several parts of Scotland; but he observes that it has ever been confounded by authors with *Uria Troile,* which it so nearly resembles. He further states that *Uria Alle* (*Little Guillemot, Little Auk* of authors) collects during the breeding season in vast numbers along the north and east coast of Baffin's Bay, but is seldom to be met with far to the westward of Lancaster Sound. A few were seen by the expedition near Leopold Island, and two or three specimens were obtained.

We select as examples of the genus *Uriæ Troile* and *Grylle*—

Uria Troile.—Description of both sexes (old) in their winter dress. Summit of the *head,* space between the eye and the bill, longitudinal band behind the eyes, and all the upper parts, of a velvetty black slightly inclining to ash: all the *lower parts* and the extremity of the secondaries pure white: white is also found between the band behind the eyes and the back of the nape, and advances towards the occiput, where it forms on each side an open angle. The ashy blackish colour of the lateral part of the neck seems to form towards the breast a kind of collar, feebly indicated by bright ash. *Bill* ashy black; inside of the mouth livid yellow; *iris* brown; feet and toes yellowish brown; posterior part of the tarsus and membranes black. Length from the bill to the claws rather more than 15 or 16 inches. N.B. The female is rather less than the male. In this state Temminck, whose description we have given, considers the bird to be *Uria Suarbag* and *Ringuia* of Brünnich; *Colymbus minor* of Gmelin; *Lesser Guillemot* of Pennant; *Der Dumme Lumme* of Bechstein; and *Troillumme* of Meyer.

Summer, or *Nuptial, Plumage.—Head,* region of the eyes, throat, and all the upper part of the neck, of a velvetty brown; inside of the mouth bright yellow: the rest of the plumage as in winter. Thus clad it is *Uria Lomvia* of Brünnich; *Colymbus Troile* of Linnæus and Gmelin; *Le Guillemot* of Buffon; *Foolish Guillemot* of Latham; *Uria Maggiore,* Stor. degl. ucc. (Temminck).

Young of the Year.—Principally distinguished from the old birds in their winter plumage, by the comparative shortness of the bill, which is ashy and yellowish at the base; the black of the upper parts is clouded with ash-colour; the stripe or longitudinal band is not distinct, and mingles by means of ashy spots with the white of the sides of the occiput. Ashy brown predominates on the lower parts of the neck, and the white of the lower parts is not so pure; the tarsi and toes are of a livid yellowish hue. It is then *Colymbus maculâ nigrâ pone oculos,* Sander. Naturf. Gmel. i., p. 584. var. β. (Temminck).

Accidental Varieties.—No white on the secondary quills. M. Temminck states that he killed an old Guillemot in the spring, which had the whole of the back and the caudal feathers mottled with yellowish ashy stains.

This species is the *Gwilym* and *Chwilog* (the latter term applicable to the state in which Pennant calls it the *Lesser Guillemot*) of the ancient British, and is called *Willock* in the south of England, *Skout* in Yorkshire, and *Kiddaw* in Cornwall. The number of Provincial names is very great.

Geographical Distribution.—The Arctic Seas of the Old and the New Worlds; migratory in winter in large companies along the coasts of Norway and England; very common at that time along the shores of the Baltic and the maritime coasts of Holland and France; more rarely found 'upon our seas and great lakes of the interior.' (Temminck.) Spitzbergen, Lapmark, and the White and Icy Seas as far

as Kamtchatka. Along the whole coast of Hudson's Bay, Labrador, and Newfoundland. (Nuttall.) The great body of the American birds of this species winter in the Bay of Fundy. (Audubon.)

In the British Islands they are numerous (among other localities) in the Orkneys, on the Bass Rock, the Farn or Fern Isles, the cliffs of Scarborough, the Needles and cliffs of the Isle of Wight, the Goodeve Rocks not far from St. Ives in Cornwall, and the Isle of Priestholm, contiguous to the Island of Anglesey, &c. (See further, *Geographical Distribution of the Genus*, above.)

Uria Troile. An adult and a young bird of the year.

Habits, Propagation, Food, &c.—The appellation of *Foolish Guillemot* has been given to this species from its often suffering itself to be taken by the hand or killed on the spot, especially in the breeding season, rather than quit the cliff it has chosen for its abode. The sea is the favourite resort of these birds when they leave their cliffs, and there they seek their food, consisting principally of small fish,* small marine crustaceans, and small bivalves, diving with the greatest facility. They are with difficulty roused to flight. Early in April and May, or at the end of March, they begin to assemble on their favourite cliffs in Britain, and lay their single unprotected egg on the flat bare ledge of rock. This egg is generally of a pale green, blotched and stained with black and dark brown (umber). Sometimes the egg is white, with or without a few spots. It is a remarkable sight to see these birds, where they abound, sitting upon their eggs on their rocky shelves, often in line, and so close that they nearly touch each other. As soon as the young are capable of migrating, which is in August, or by the end of that month, they are said to disappear from our shores. Mr. Selby, whose observations are always valuable, gives the following interesting account of these birds: 'Incubation lasts for a month, and when the young are first excluded they are covered with a thick down, of a blackish-grey colour above, and white beneath. This gradually gives place to the regular plumage, and in the course of five or six weeks from the time of hatching they are capable of taking to the water. During the time they remain upon the rock the parents supply them plentifully with the young of the herring and herring-sprats, which form the principal food of this and other species belonging to the *Alcadæ*. Upon the Northumbrian coast these Guillemots breed in great numbers on the Fern Islands, a locality that has afforded me ample opportunities of attending to their economy and watching the changes they undergo. They have selected the summits of three fine isolated pillars, or masses of *whinstone* (trap-rock), that rise upwards of thirty feet above the level of the sea. Upon these the eggs are laid as close as possible, merely allowing room for the birds to sit upon them, which they do in an upright position. The appearance they make in a dense mass is curious, and the interest is increased by the number of Kittiwakes (*Larus Tridactylus*) which hover around, and which breed in the small side clefts, or on the projecting angles of the rock; and by the nests of two or three Crested, or Green, Cormorants, which, from the unusual confidence they display in continuing to sit upon their eggs, even when overlooked from the opposite precipice at only a few yards' distance, seem to be well aware of the security of the station they have chosen. The great body of the breeding birds arrives towards the end of March, or the beginning of April, at which time most of them have acquired the perfect nuptial plumage. I have however obtained them much earlier, and when the white upon the throat was only giving place to the pitch-coloured black that distinguishes them till after the sexual intercourse. At this time they often lose so many of their quill-feathers as to be totally incapable of flight; but these are soon reproduced, and the colonies which had made the English coasts their summer quarters retire to more southern latitudes to pass the winter months. Their place in this country is but sparingly supplied by a few stragglers from the great bodies that, being bred in still higher latitudes, make the firths of Scotland and its isles the limit of their equatorial migration.' (*Illustrations of British Ornithology*, vol. ii.)

Utility to Man.—Much cannot be said in favour of the flesh of the Foolish Guillemot, though the people of Kamtschatka kill numbers of those birds for food. The principal reason however for the attack upon them arises from the value of their skins as an article of clothing to the inhabitants of those cold regions. The eggs seem to be generally accounted delicacies.

Uria Grylle. Description of both sexes in complete winter plumage.—Summit of the *head*, nape, and all the *upper parts*, with the exception of the middle of the wings, of a rather deep black; the wing-coverts forming a large white space, or speculum. Cheeks and all the *lower parts* from bill to tail pure white; *irides* red.* *Bill* black; interior of the mouth and feet bright red. Length from bill to claws about 13 inches. In this state M. Temminck, whose description we have selected, says that *Uria minor striata* of Brisson, *Uria Baltica* and *Grylloides* of Brunnich, are individuals in different stages of moulting, passing from winter plumage to that of summer; that the *Spotted Greenland Dove* of Edwards (*Glean*, t. 50) is a very exact figure of a moulting individual; and that the *Spotted Guillemot* of the 'British Zoology' and Latham (Syn.) are varieties or different states of the autumnal and spring moults.

Young of the Year.—Throat, breast, and the *lower parts* white; summit of the *head*, nape, lower part of neck and sides of the breast blackish, spotted with grey and white; back and rump of a dusky black, some of the scapulars and feathers of the rump terminated with whitish ash; *wings* black, with the exception of the speculum, which is white, but marked with ashy or blackish stains; inside of the mouth and feet livid reddish; *iris* blackish-brown.† In this state there is a very faithful figure of the bird in Frisch, *Vög. Deutsch.*, t. 185 (Temminck).

Summer Plumage, or *Nuptial Dress.*—*Male*—The whole plumage, the middle of the wing alone excepted, of a sooty-black; wing coverts forming a large space or speculum of pure white. *Bill* black, the inside of it and the feet bright red.

Female.—Rather less. The black of the plumage less deep, and the white of the plumage less extended and less pure. At the periods of the two moults white feathers in more or less quantity are visible on the under parts of both sexes. M. Temminck, who gives this description, refers to the following synonyms and works as illustrative of this state of plumage, and some of its stages: *Uria Grylle*, Lath.;

* The anchovy and sardine are their favourite food in the Mediterranean.

* Temminck says brown; but Mr. Gould ('Birds of Europe') describes and figures them as red in the adult, and this we believe to be right.

† In our copy of Frisch the iris is coloured red. In Mr. Gould's 'Birds of Europe' the iris is brownish, inclining to olive, and the feet are yellowish-brown.

Colymbus Grylle, Gmel. (Linn.?); *Columba Groenlandica*, Briss.; *Le Petit Guillemot Noir*, Buff.;* *Black Guillemot*, Lath. (Syn.); Penn. *Brit. Zool.*, p. 138, t. H. 4, an individual preserving some of the feathers of its youth; Penn. *Arct. Zool.*, p. 516, No. 437—Edw., *Glean.*, t. 50; *Der Schwarze Lumme*, Bechst., *Naturg. Deutsch*, v. iv., p. 586—Meyer, *Taschenb.*, vii., p 446—Meyer, *Vög. Deutschl.*, v. i.—Heft. 13, t. 3 and 4—Naum. *Vög.*, t. 64, No. 6, f. 100, very old male.

M. Temminck remarks that the indications of the pretended species, *Cephus lacteolus* (Pallas, *Spic.*, v. 5, p. 33), which Latham has recorded as his *Uria lacteola* (*Ind.*, v. 2, p. 798, sp. 3)—*Colymbus lacteolus* (Gmel.)—have reference to an individual in its winter plumage, accidentally variegated with white; and that this albino was obtained by Pallas on the maritime coasts of Holland.

Mr. Selby observes that from the short description given by Cuvier of his genus *Cephus*, in the 'Règne Animal,' it is evident that the Rotche, or Little Auk of some of our writers (*Alca Alle*), is there considered to be its typical representative, and not the *Black Guillemot*; and, he observes, this appears still more evident from the note at the bottom of the same page, in which (after adverting to the figures of the *Lesser* and *Spotted Guillemots* in the second volume of Pennant's 'British Zoology,' pl. 83) Cuvier says, 'Ces sont des Guillemots proprement dits. Au contraire, *l'Alca Alle*, Penn. ('British Zoology,' 11, pl. 82, 1; Albin, 1, 85), appartient aux *Cephus*.' Mr. Selby goes on to remark that Dr. Fleming has, however, appropriated this generic term to the *Black Guillemot*, making the distinction between it and *Uria* to consist in the want of a terminal notch in the upper mandible; but, as this character does not appear to be constant, Mr. Selby having seen some specimens with the notch, though not so fully developed as in the *Foolish Guillemot*, he has retained it in the situation where it was originally placed by Dr. Latham.

The note alluded to by Mr. Selby is in the first edition of the 'Règne Animal;' but, in Cuvier's last edition (1829), which Mr. Selby does not appear to have seen†, the note is omitted. In this edition the generic appellation '*Cephus* (Vulg. *Colombes de Groenland*)' is retained with the same characters, but the subsequent part is very much altered; for it stands thus in the last-mentioned edition:—'The species most known, called *Petit Guillemot*, or *Pigeon de Groenland* (*Colymbus Minor*, Gm. Enl. 917; *Mergulus Alle*, Vieill., Gal. 295; 'Brit. Zool.' pl. H. 4, f. 1; Edw., 91; Naum., 1st. ed., 65, f. 102), of the size of a good pigeon, is black above, white below, with a white mark on the wing as in the Guillemot. Its bill is black and its feet are *red*. It inhabits all the coasts of the north and *nestles under ground* ('niche sous terre'). We see it also sometimes in winter.' Notwithstanding the confusion in the passage just quoted and some parts of the description references and alleged nidification, which can hardly be made to apply to the *Little Auk*, or *Rotche*, it seems probable that Cuvier meant to take that bird, as Mr. Selby observes, as the type of his genus *Cephus*.

Uria Grylle, *Black Greenland Dove*, *Sea Turtle*, or *Dovekey* of the Northern Voyagers, is the *Sesekèseweuck* of the Cree Indians, and *Gwylim dû*, *Eas gan longwr*, of the antient British.

Geographical Distribution.—Inhabits the same countries as *Uria Troile*; migratory during winter along the borders of the ocean; more rarely seen on land than *Uria Troile*, and then only by accident; very rare in the seas and lakes of the interior. (Temminck.) Widely distributed in the Arctic Circle and met with in very high latitudes, inhabiting all the icy regions of Europe and North America. (Selby.) Abounds in the Arctic Seas and Straits, from Melville Island down to Hudson's Bay, and remains, though in diminished numbers, all the winter in the pools of open water, which occur, even in high latitudes, among the floes of ice. Small flocks extend their migrations, in that season, as far south as the United States. (Richardson.) See further, *Geographical Distribution of the genus*, above, and the next paragraphs.

Habits, Propagation, Food, &c.—Mr. Selby observes that in the northern parts of Scotland and its isles this is a numerous species, but becomes of rarer occurrence as we approach the English coast, where indeed it is but occasionally met with. 'Although Montagu,' continues Mr. Selby, 'has mentioned it as resorting to the Farn Islands, and Mr. Stephens has repeated the same, I can safely assert that this has not been the case for the last twenty-five or thirty years, having been in the habit of visiting this group of islands almost annually during that period; and had it been a visitant, I feel confident it could not have escaped my observation, or that of the keepers of the lighthouse, who reside there. It certainly breeds, though in very small proportion, upon the Isle of May, at the mouth of the Frith of Forth, but is not found in large congregated numbers till we reach the vicinity of the Orkney and Shetland Isles. In these parts it is resident throughout the year, never migrating to the same extent as the preceding species (*Uria Troile*) and the Razor-bill Auk. Its habits are very similar to those of its congeners, and it is rarely seen upon land, except for the purposes of incubation. It breeds in the crevices or on the ledges of rocks, from whence it can readily drop into the water or get upon wing, and lays a single egg, of a greyish-white, speckled with black and ash-grey. Its food consists of fish, crustaceæ (crustacea), &c.' So far Mr. Selby, with whose accuracy as an observer we have often had occasion to be satisfied. Mr. Gould moreover speaks of its depositing on the ledges of the rocks 'its single egg.' We must however now let one of the most indefatigable observers speak for himself, more especially as his account differs so essentially from those abovementioned, and indeed from those of most other authors, except Nuttall. 'Wherever,' says Audubon, 'there are fissures in the rocks, or great piles of blocks with holes in their interstices, there you may expect to find the Black Guillemot. Whether European writers have spoken of this species at random, or after due observation, I cannot say. All I know is, that every one of them whose writings I have consulted says that the Black Guillemot lays only *one egg*. As I have no reason whatever to doubt their assertion, I might be tempted to suppose that our species differs from theirs, were I not perfectly aware that birds in different places will construct different nests, and lay more or fewer eggs. Our species always deposits three, unless it may have been disturbed; and this fact I have assured myself of by having caught the birds in more than twenty instances sitting on that number. Nay, on several occasions, at Labrador, some of my party and myself *saw* several Black Guillemots sitting on eggs in the same fissure of a rock, where every bird had three eggs under it; a fact which I communicated to my friend Thomas Nuttall. What was most surprising to me was, that even the fishermen there thought that this bird laid only a single egg; and when I asked them how they knew, they simply and good naturedly answered that they had heard so.' The same graphic author addressing the reader tells him, in order to satisfy himself, to go to the desolate shores of Labrador. 'There,' continues the American ornithologist, 'in the vernal month of June, place yourself on some granite rock, against the base of which the waves dash in impotent rage; and ere long you will see the gay Guillemot coming from afar by the side of its mate. They shoot past you on fluttering wings and suddenly disappear. Go to the place; lay yourself down on the dripping rock, and you will be sure to see the birds preparing their stony nest, for each has brought a smooth pebble in its bill. See how industriously they are engaged in raising this cold fabric into the form of a true nest, before the female lays her eggs, so that no wet may reach them from the constant trickling of the waters beneath. Up to the height of two or three inches the pebbles are gradually raised: the male stands by his beloved; and some morning when you peep into the crevice, you observe that an egg has been deposited. Two days after you will find the number complete.' (*Ornithological Biography*, vol. iii.)

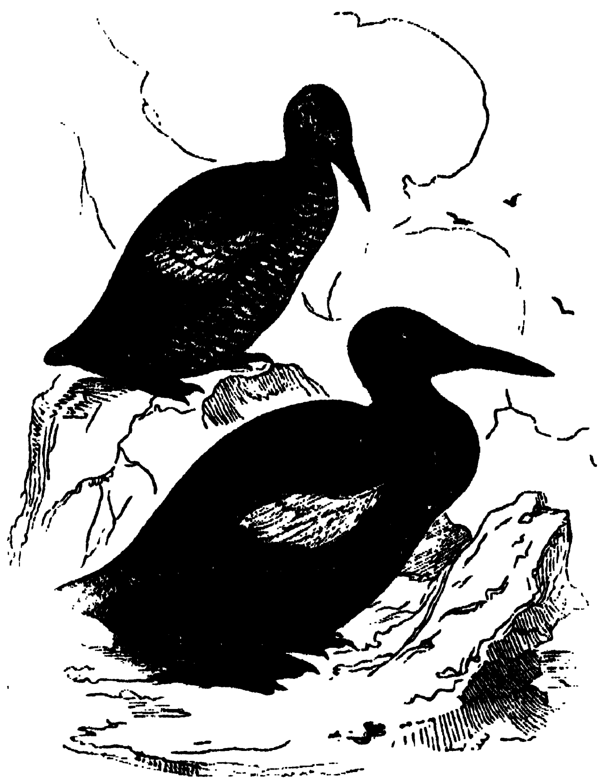
Utility to Man.—Captain James Ross, R.N., who, in March, 1823, shot near Igloolik the specimen described by Dr. Richardson, says that one individual only was obtained by the expedition during the winter, although several other were seen off Fury Point, in February, 1833. It was, he adds, subsequently met with in great numbers as they travelled along the high precipitous land between Fury Point and Batty Bay, where the birds congregated in vast quantities during the breeding season, affording to the party many delicious meals, and proving a valuable addition to their then scanty stock of provision. Several thousands

* M. Temminck speaks of Buffon's description as being correct, but not so the figure in the 'Planches enluminées' (917).

† The date of Mr. Selby's 2nd vol. of 'Illustrations of British Ornithology' is 1833.

were shot by their sportsmen; and by means of this providential supply of fresh food, several of the men, who had been long afflicted with that most dreadful malady the sea-scurvy, were restored to health. Captain J. Ross adds that it is not equal in flavour to *Uria Troile*, but is much more numerous and more extensively dispersed along the coasts of the Arctic Seas.

The species of this genus are but few. Speaking of



Uria Grylle. An adult and a young bird.

Uria lachrymans, the *Bridled Guillemot*, Mr. Gould, in his 'Birds of Europe,' where it is beautifully figured, states that he is doubtful of its specific value, as it bears so close a resemblance to *Uria Troile*, from which it differs only in the white mark which encircles the eyes and passes down the sides of the head. It inhabits the same localities as *Uria Troile*, and is even often found in company with it on various parts of our coast, particularly in Wales, where Mr. Gould has been informed both kinds are equally numerous. He remarks that it was first described as distinct by Choris, who states that it is abundant at Spitzbergen and in the neighbouring seas; and adds that M. Temminck and the French naturalists consider these two *Uriæ* distinct. There can be no doubt that *Uria Brunnichii*, the distinctions of which have been well pointed out by Capt. Sabine in his memoir on the birds of Greenland, is a well-defined species.

GUILLOTINE, an instrument for the infliction of capital punishment, proposed to the National Assembly of France by Joseph Ignace Guillotin, a physician, a native of Xaintes, and a member of the Assembly; and which from him took its name. It was adopted by a decree of the 20th of March, 1792.

This instrument, under other names, had existed as a means of public execution long before, in Germany, Bohemia, Italy, Scotland, and England.

Crusius in his 'Annales Suevici,' fol. 1595-6, tom. ii., p. 296, says, 'Antiquis autem temporibus, in Germania etiam, decollatio non gladio fiebat, sed querno ligno, habente scindens acutissimè ferrum. Addit Widemannus, se vidisse tale instrumentum Halæ in vetere Nosodocheo (Siechaus) priusquam id destrueretur: et hodiernum ibi ædificaretur. Efferebatur inde illa machina, si quis plectendus esset: supplicioque peracto, eodem referebatur.'—'Postea usus gladii successit.'

In German this instrument was called *der Planke der Deil* (the plank of wood), and in older language *Falbiel* (the falling hatchet). In Bohemia it was called *Hagec*, something akin to the plank. In Italy it was known by the name of *Mannaia*, and an engraving of it may be seen in 'Achillis Bocchii Bonon. Symbolicarum Quæstionum, lib. v.,' 8vo., Bonon., 1555, p. 36. There is a very beautiful engraving of the German instrument in a representation of the beheading of the son of Titus Manlius, by Henry Aldegrevers, dated 1553. Evelyn, in his Memoirs, vol. i., p. 170, states that he saw a similar instrument at Naples.

Pennecuik, in his 'Description of Tweeddale,' pp. 16, 17, speaking of the Regent Morton of Scotland, says: 'This mighty earl, for the pleasure of the place and the salubrity of the air, designed here a noble recess and retirement from worldly business, but was prevented by his unfortunate and inexorable death, three years after, anno 1581, being accused, condemned, and executed by the *Maiden* at the Cross of Edinburgh, as art and part of the murder of King Henry, earl of Darnley, father to King James VI., which fatal instrument, at least the pattern thereof, the cruel Regent had brought from abroad to behead the Laird of Pennecuik of that ilk, who notwithstanding died in his bed, and the unfortunate earl was the first himself that handselled that merciless *Maiden*, who proved so soon after his own executioner.'

In England, what has been since called the Guillotine was used only at Halifax in Yorkshire, and confined even there to the punishment of felonies committed within the forest of Hardwick. Its use at Halifax is traced as far back as the time of Edward III. It was in 1650 that the last malefactors there suffered by it. (Watson's *Hist. of Halifax*, p. 214-239.)

Joseph Ignace Guillotin, who revived the use of this instrument, in France, is supposed, by many, to have perished at a later period of the Revolution, like the Regent Morton by his own invention. But this is not correct. He died a natural death, 26th May, 1814, at the age of 76. (*Biogr Universelle.*)

GUIMARAËS. [ENTRE DOURO E MINHO.]

GUINEA, an extensive country on the west coast of Africa, between 4° and 10° N. lat., and 5° E. and 13° W long., has a coast-line of more than 1800 miles. The inland part is almost entirely unknown, with the exception of the country of the Ashantees, and the countries lying along the route by which Captain Clapperton and the Landers entered the interior of Africa. The coasts have been visited by European vessels for four centuries, and several settlements were formed on it, most of which however have been abandoned since the abolition of the slave trade. The countries along the sea-coast are known to European sailors under six names—Sierra Leone, Grain Coast, Ivory Coast, Gold Coast, Slave Coast, and Benin. We shall notice here only the second, third, and fifth, having already given an account of the Gold Coast [COAST, GOLD; ASHANTEES], and of Benin [BENIN, RIV. and BIGHT]. Sierra Leone is treated in a separate article.

The Grain Coast extends from Cape Mesurado (7° N. lat.) to Cape Palmas (4° 30′ N. lat.), a distance of somewhat less than 300 miles. The high land, which occupies nearly the whole space between the Bay of Guinea and the Sahara, advances here, as in Sierra Leone, close to the sea, forming a bold and rocky coast. The interior is a succession of mountain-ridges and of valleys. The mountains are mostly wooded, and the valleys wide and fertile, producing rich crops of rice, which is exported to a large amount. Cattle, sheep, pigs, goats, and poultry, are abundant. Besides rice, ivory and cam-wood are exported. It produces also a sort of coarse pepper, called by the Dutch grains, and by the Portuguese sextos, which was formerly sometimes brought to Europe, when the supply from the East Indies was deficient. The coast is now only visited by vessels which sail between the settlements of Sierra Leone and those on the Gold Coast, though several of its rivers offer great facilities for trade, being navigable for small vessels to a considerable distance in the interior. It seems that the whole country is divided into three kingdoms. The most western is the kingdom of Cape Mount, which extends on both sides of Cape Mesurado, and comprehends a coast of about 160 miles, reaching more than 100 miles inland. Its capital, Couseea, is said to have a population of 15,000. At Kingston there is a small English settlement. The middle of the coast is occupied by the kingdom of Sanguin, from which much palm-oil is obtained. Its principal port is Bassa. [BASSA.] Within its boundary is the American settlement of Liberia, established in 1821. The capital, Monrovia, had

some years ago 700 inhabitants, and the whole population exceeded 2000 souls. The country near Cape Palmas is occupied by the Settra Croo, a tribe of negroes, distinguished by their industry; they are met with in almost all the European settlements, where they work for wages.

The Ivory Coast occupies the countries between Cape Palmas and Cape Three Points (Tres Puntas), a distance of nearly 400 miles. Our navigators however add the eastern districts as far as the river Asinee, about seventy miles east of Cape Lahoo, to the Gold Coast. In this part the high land of the interior does not come close to the beach, but is divided from it by a low tract, about ten or twelve miles wide on an average. This part of Guinea, which is less frequented than any other, appears to be inhabited by a number of small negro tribes, living in a state of independence, except those of the western district, which are dependent on the Ashantees. The English and Dutch had some establishments west of Cape Three Points, but they have been abandoned, with the exception of the Dutch fortress of Axim. [COAST, GOLD.] Near Cape Palmas is a harbour formed by a reef, which is the only sheltered one on this part of the coast. It is spacious, perfectly secure, and has good anchorage.

The Slave Coast begins on the west at the Rio Volta, which empties itself into the Gulf of Guinea, near the meridian of Greenwich, and is considered as the boundary-line between it and the Gold Coast: it extends eastward to the neighbourhood of the river Formosa, or Benin, a distance of more than 400 miles along the sea-shore. The Rio Volta, which comes down from a great distance (some say 400 miles), is a broad river in the interior, but towards its mouth it divides into several branches, and forms a kind of delta. The shores of this coast are flat and low, and partly rendered inaccessible by sand-banks. They are covered by extensive salt-marshes and numerous lagoons, traversed by several rivers, among which the Lagos is the most considerable. It is stated that at least during and shortly after the rainy season a water communication exists between the rivers Lagos and Volto, by means of short natural canals uniting a number of lagoons. The plain extends inland 80 or 100 miles; it is fertile, open, and level, exhibiting large savannahs covered with high grass; in some parts however it is thickly wooded with fine trees. Farther inland, where the ground rises, it is covered with extensive and thick forests. The greatest part of the plain is converted into a swamp during the rainy season, from May to October. The whole plain, with the mountain-region extending north of it, seems to be divided between the kingdoms of Dahomy, Ardrah, and Lagos. Dahomy occupies the western portion, lying contiguous to the country of the Ashantees. It extends from the coast to a great distance inland, perhaps to 9° N. lat. Its capital, Abomy (7° 12′ N. lat.), lies in the mountain-region, and is stated to contain 24,000 inhabitants. Calmina, farther south, has 15,000 inhabitants; and Whydda is also considerable. The principal harbour of Dahomy is Grewhe (according to Adams, 6° 17′ N. lat. and 3° 6′ E. long.), with 6000 or 7000 inhabitants. The kingdom of Ardrah extends east of Dahomy, and is less extensive, comprehending only a considerable portion of the plain. Its capital, Ardrah (6° 26′ N. lat.), is built on the banks of a lake, and contains 20,000 inhabitants. Its port is Porto Novo. The kingdom of Lagos occupies the countries extending on both sides of the lower course of the river Lagos. In its territory are the towns of Lagos, with about 5000 inhabitants; and Badagry, with a population of 10,000 souls. But the king of Lagos is dependent on the king of Yarriba, whose dominion extends over the whole breadth of the Kong Mountains to the banks of the river Quorra, and along that river to 10° N. lat. The mountains rise only to about 2500 feet on an average, and stretch out in extensive levels, and are mostly covered with luxuriant grasses and fine trees. This part of the continent is also pretty well cultivated, and comparatively thickly peopled, containing a considerable number of large towns, as Katunga, the capital of Yarriba; Dufo, with 15,000 inhabitants; Choodoo, with 7000 inhabitants; Koosoo, with 20,000 inhabitants; and Artoopa, with 6000 inhabitants. These towns lie on the road which Captain Clapperton and the Landers followed on their route into the interior of Africa, and we may fairly conclude that there are many more of equal importance. The climate of this higher region is less hot and more healthy than the low plain along the sea-coast, which in this respect does not much differ from that of the Gold Coast, except that the extensive swamps which cover it near the shores render it still much more unhealthy.

(Dalzel's *History of Dahomy;* Robertson's *Notes on Africa;* Hutton's *Voyage to Africa;* Adams's *Remarks on the Countries extending from Cape Palmas to the River Congo;* Monrad's *Gemählde der Küste von Guinea;* Lamarthe's *Voyage à la Côte de Guinea;* Bowdich's *Mission to Ashantee;* Clapperton's *Journal of a Second Expedition into the Interior of Africa;* Lander's *Expedition to determine the Course and Termination of the Niger.*)

GUINEA, NEW. [PAPUA.]

GUINEA. [MONEY.]

GUINEA-FOWL. [PHASIANIDÆ.]

GUINEA PEPPER, the seeds of two species of Amomum, found on the west coast of Africa, within the tropics; the one, A. grana Paradisi, the other, A. grandiflorum. They are powerfully aromatic, stimulant, and cordial, and are used for the same purposes as Cardamoms.

GUINEA-PIG (*Cavia Cobaya, Restless Cavy*), the well-known Brasilian rodent now domesticated in Europe. [LEPORIDÆ.]

GUINES. [PAS DE CALAIS.]

GUINGAMP, a town in France, in the department of Côtes du Nord, on the right bank of the river Trieux, and on the high road from Paris to Brest, 295 miles from Paris. The town is walled, and surrounded with pleasant walks. The church has two lofty towers; and there is a handsome market-house, with a fountain in front of it in the market-place. The population in 1831 was 6100. There are manufactures of linens, which take their name from the town, and of linen thread, earthenware, and leather. There are a court of justice and an agricultural society. There are twelve yearly fairs, at which much business is transacted in corn, cattle, flax, hemp, and linens. Potters' clay is dug in the neighbourhood.

Guingamp was antiently capital of the county of Penthièvre, united with Bretagne. It is now the chief town of the arrondissement, which contains 10 cantons, 73 communes, and had, in 1831, 115,679 inhabitants.

GUIPU'ZCOA is situated at the eastern extremity of the northern coast of Spain, and although the smallest, is the most interesting of the three Basque provinces mentioned in a former article. The river Bidassoa separates it from France on the east. It enjoys the north breeze from the Bay of Biscay, and is free from the sultry heats of Alava. It contains 32 square leagues and about 104,500 inhabitants. If Spain were equally peopled throughout, it would contain full 30,000,000 inhabitants. Guipuzcoa, although wholly mountainous, is most carefully cultivated. Apples grow plentifully in the fields, and produce an excellent cider. Corn however and other necessaries fall short of the consumption. These deficiencies in the products of the soil are amply compensated by the abundance of fine iron-ore, which is smelted on the spot, and converted into sundry articles, which, owing to the tenacity and elasticity of the material, are preferable to other wares of the kind which have a finer appearance. The Basque fowling-pieces are in demand both at Spain and abroad; the muskets, swords and bayonets, anchors, implements, nails of all sizes, &c., are uncommonly well made. To these staple products of native industry may be added furniture, hides, skins, hats, paper, linen, cloth, rigging, oars, &c. Much activity and skill are displayed by the females of this country. Occupations which in other countries belong exclusively to males are cheerfully undertaken by them; and among other things they handle the oar with surprising dexterity. But they are above all accomplished housewives, and far from deficient in personal attractions. The farms, roads, dwellings, customs, and the countenance and dress of the people, all form a powerful contrast between the state of Guipuzcoa and the interior of Spain.

Moret is of opinion that the independence of the Basques originated in some arrangement between Justinian and Athanagild. Subsequently when Recaredo applied to Gregory the Great for a copy of this contract, the pope would not comply with the request, because the stipulations were unfavourable to the Goths. Guipuzcoa, with the other Basque provinces, was sunk in the general denomination of Cantabria and also of Vardulia, which latter term comprehended Old Castile. According to trustworthy traditions Guipuzcoa submitted in 1200 to Alfonso VIII., called 'El de las Navas' for his victory gained at that place over the Moors, whose empire from that event dates its irretrievable

decline. The navy of the Guipuzcoans soon afterwards proved most efficient in the siege and conquest of Seville by Ferdinand III. It must have been considerable at a still later date, since it lost 26 large ships in a battle fought the 29th August, 1350, against Edward III. of England.

The whale fishery was formerly and from time immemorial carried on by the Guipuzcoans on their own coast. They afterwards extended their adventures to Newfoundland and to Greenland, where about 200 years ago they were unmercifully dealt with by the English whalers. The cod fishery was also carried on successfully by the Guipuzcoans, particularly on the banks of Newfoundland, in the sixteenth and seventeenth centuries. The priority in that branch of industry is ascribed to them in common with the Biscayans. The Basque word 'bacallao' for 'cod' is used all through Spain.

The windmills which Alonso XI. permitted the town of San Sebastian to erect in 1332 are said to be the oldest in Spain, and perhaps in Europe. La Flamme, who lived in the fourteenth century, is the first who mentions the invention.

Whatever may be the different claims to the modern discovery of the Canaries, the Guipuzcoans had at all events reached those islands before the Norman baron Bethencourt obtained a grant of them from Henry III. of Castile. It was the good fortune of a Guipuzcoan, Sebastian de Elcano, to arrive at San Lucar with the ship Victoria, on the 6th September, 1522, three years and 14 days from the time when the first expedition for the circumnavigation of the globe set sail under Magalhaens, whom an untimely and cruel death at the Philippine Islands deprived of that glory.

In 1728 the company of Caracas was established for the protection of commerce in that part of America, chiefly against the Dutch. It was afterwards united with the Compañia de Filipinas.

(*Dicc. Historico-Geografico, por la Academia de la Historia*, Madrid, 4to., 1802; *Diccionario de* Miñano; Antillon; *Nueva Recopilacion de los Fueros de Guipuzcoa*, fol., Tolosa, 1696, and its *Supplemento*, 1758.)

GUISCARD, ROBERT. [NAPLES.]

GUISCHARD, CHARLES, a colonel in the service of Frederic the Great, distinguished himself in the Seven Years' War, after the end of which he availed himself of the leisure of peace to write several works on the military art of the antients:—1. 'Mémoires Militaires sur les Grecs et les Romains,' in which he criticises the opinions of Folard, and exposes his mistakes. [FOLARD.] 2. 'Mémoires Historiques et Critiques sur plusieurs Points d'Antiquités Militaires,' which contains a reply to the Chevalier Looz, who had written a book in defence of Folard.

GUISE, or GUYSE, DUKES OF, the title of a branch of the sovereign house of Lorraine, which settled in France at the beginning of the sixteenth century. Claude of Lorraine, fifth son of René II., duke of Lorraine, and of Philippa of Guelderland, after contesting his father's succession with his elder brother, went to France, where he married Antoinette de Bourbon in 1513. He served with distinction in the French armies, and was severely wounded at the battle of Marignan in 1515. In 1527, Francis I. made him duke of Guise in Picardy, and peer of France. He died in 1550, leaving a numerous family. One of his daughters married James V. king of Scotland, by whom she had Mary Stuart. Claude's eldest son, Francis, born in 1519, succeeded to the title of duke of Guise. He had been previously made by Henry II. duke of Aumale, or Albemarle, in Normandy, in 1547, and he married Anna of Este, daughter of the duke of Ferrara, and grand-daughter, by her mother Renée, of Louis XII. Francis of Guise was the most illustrious of his family, both for his military talents and for his humanity and generosity, qualities not very common among the warriors of that age. Owing to a severe wound which he received in his face at the siege of Boulogne in 1545, and which left a scar for the rest of his life, he was called Balafré, or 'Scarred.' He fought in the wars against Charles V., and afterwards against Philip II., and took Calais from the English, who had possessed it for more than two centuries. He and his brother Charles, cardinal of Lorraine, had the principal share in the government of France under the reigns of Henry II. and Francis II. The conspiracy of Amboise (as it was called) by the Calvinists and the prince of Condé, was intended to overthrow the power of the Guises; but the duke having had timely information of it, removed King Francis II. to Amboise, and had himself appointed lieutenant-general of the kingdom, upon which most of the conspirators were arrested and executed. Under Charles IX. the influence of the Guises somewhat declined, the court being divided between two parties, that of Guise and that of Condé and Coligny. The war of religion having broken out in 1562 by the affray at Vassy, where the duke of Guise's servants and attendants killed a number of Calvinists, the duke fought under the Constable of Montmorency at the battle of Dreux. Shortly after he was murdered in his camp before Orleans by Poltrot de Méré, a Calvinist, who looked upon him as the most formidable enemy of his co-religionists. The character of Francis duke of Guise has been the object of party misrepresentations, in consequence of his having lived in times of religious and civil strife. Francis's eldest son, Henry, also called the Balafré, from a scar which he received in battle, succeeded to his father's titles, and became the leader of his powerful party Less magnanimous and more factious than his father, he mixed deeply in all the intrigues and plots of the League, a political and religious association first projected by his uncle, the cardinal of Lorraine, ostensibly for the purpose of defending the Catholic religion and the king, but in reality to rule over both king and kingdom for party purposes. Henry of Guise was one of the advisers of the St. Barthelemy, and he ordered the murder of Coligny. He excited the fury of the bigoted populace against the Calvinists, whom he not only defeated in battle, but hunted down in every part of the kingdom, with all the ruthlessness of personal hatred. After the death of the imbecile Charles IX., he ruled at will over the weak and profligate Henry III., and obliged him to break the promises of peace and toleration which he had made to the Calvinists. Henry III. however, and even his mother Catherine of Medici, became jealous of the ambition and weary of the insolence of the Guises, and the duke was forbidden to appear at the court and at Paris. Upon this he then openly raised the standard of revolt against his sovereign, and defeated him in his own capital on the 12th May, 1588. This was called the 'Day of the Barricades.' The king left Paris, and withdrew to Chartres, from whence he convoked the states-general of the kingdom to assemble at Blois. There seems no doubt that the faction of the Guises intended to dethrone Henry, and that for that purpose it kept up a treacherous correspondence with the Spaniards, who were then the enemies of France, and the pope. The states were opened at Blois on the 16th October, 1588, and the deputies were found to be almost wholly in the interest of the duke of Guise and his brother the cardinal, who were present. The session was stormy, and the royal authority in danger. The duke demanded to be appointed high-constable and general-in-chief of the kingdom. Henry III., pusillanimous and unprincipled, and advised by courtiers as wicked as himself, resorted to assassination in order to get rid of the Guises. Crillon, the commander of the French guards, was sounded for the purpose. 'I will fight him openly,' answered that brave officer, 'and shall endeavour to kill him.' This did not suit Henry, who found a more docile instrument in Lognac, first gentleman of the chamber, who picked out nine Gascons of the new body-guard, and concealed them in the king's closet. As the duke of Guise was entering the royal apartment on the 23rd December, 1588, he was pierced with daggers, and expired exclaiming 'O God, have mercy upon me!' He died at 38 years of age. He had several great qualities; he was brave, fearless, and generous to his friends, but unprincipled, ambitious, and cruel to his enemies. The cardinal his brother was arrested and killed in prison the next day. Their brother, the duke of Mayenne, being absent, saved his life. Charles, eldest son of Henry of Guise, who was yet a boy, was arrested at Blois, and confined in the castle of Tours, from which he escaped in 1591. He and his uncle of Mayenne, and his cousin Charles duke of Aumale, became the leaders of the League against Henry IV. [AUMALE.] After that king's abjuration Charles duke of Guise submitted to him in 1594, and the duke of Mayenne followed his example next year. Charles was made governor of Provence, but under the following reign of Louis XIII. Cardinal Richelieu, jealous of his name and influence, obliged him to leave France. He retired to Tuscany, where he died in 1640. His son Henry II., born in 1614, was at first brought up for the Church; but after the death of his elder brother he quitted the clerical state, and assumed the title of duke of Guise. Having conspired against Cardinal

Richelieu, he was tried by the parliament, and condemned, *par contumace*, in 1641. In 1647 he placed himself at the head of the revolted Neapolitans [MASANIELLO], but was taken prisoner by the Spaniards; and being released in 1652, he returned to Paris, where he died in 1664, leaving no issue. His 'Mémoires' were published after his death. His younger brother, Louis duke of Joyeuse, left a son, Louis Joseph of Lorraine, duke of Guise, who died in 1671, leaving an infant son, who died in 1675, five years of age. The line of the Guises thus became extinct; but the collateral branch of the dukes of Elbœuf has continued to the present time.

GUITAR, a musical instrument which, in various shapes, may be traced to the remotest periods of antiquity. The word is derived from the Greek κιθάρα, and comes immediately to us through the French *Guitare*, though it is nearly the same in the Italian, Spanish, and German languages. The terms *Cittern* and *Gittern*, used by the old English poets, are but corruptions of the primitive word.

The English and French guitar of the last century was wide and thin in body, short in the neck, and strung with wire. The modern guitar, which is of the Spanish kind, and differing little from the lute, consists of a body from seventeen to eighteen inches in length, four in depth, and of a neck of about sixteen inches, the latter carrying a finger-board divided by seventeen frets. It has six strings, three being of silk covered with silvered wire, and three of catgut.

The compass of this elegant instrument is from E below the base staff, to A above the treble staff, including all the intermediate tones and semitones. The best and cheapest guitars are made in Germany, and may be purchased in London at a moderate price.

GUJERAT. [HINDUSTAN.]

GULDI'NUS, or GULDIN, HABAKKUK, afterwards PAUL, was born at St. Gall in 1577, and was bred a Protestant, but became a Roman Catholic in or before 1597, in which year he took the vows of a Jesuit, as *coadjutor temporalis*. Having shown a talent for mathematics, he was allowed to study at Rome, and afterwards taught, first at Grätz, then at Vienna. He wrote for the Gregorian Kalendar against Calvisius, and against Scaliger, on the precession of the equinoxes: also on the geographical problem of the method of numbering the days of those who sail to the new world [ANTIPODES], on Centrobaryca, and other things. He died in 1643. This is the account given by Riccioli of a writer whose memory would not have required notice in this work, if it had not been for some propositions mentioned by Pappus, which he appropriated without acknowledgement, and which for a long time passed under his name. These propositions are cited in the article CENTRE, and though they now merge in an elementary formula of the integral calculus, and are not used in the form in which Pappus and Guldinus exhibited them, they nevertheless give a very good conception of the properties of the centre of figure, and, under the title of the *centrobaryc method*, form an interesting step in the chain of reasonings which preceded the differential calculus.

The work of Guldinus, 'De Centro Gravitatis,' (of which the first book was published at Vienna in 1635, and the rest, owing to the disturbed state of the country, in 1640 and 1641), is a laboured geometrical treatise on the properties of the centre of gravity, including applications and verifications of the theorems of Pappus, but no demonstration. The attempt to prove these theorems was a failure in the hands of Guldinus. To put it beyond question that this writer really did borrow from his predecessor, we subjoin a paragraph from the preface of the seventh book of the collections of Pappus, taking the Latin text of Commandine, which was published before Guldinus, and which he cites. It must be remembered that the text of this preface is very imperfect. 'Perfectorum utrorumque ordinum proportio composita est ex proportione amphismatum, et rectarum linearum similiter ad axes ductarum à punctis, quæ in ipsis gravitatis centra sunt. Imperfectorum autem proportio composita est ex proportione amphismatum, et circumferentiarum à punctis quæ in ipsis sunt centra gravitatis, factarum.'

But the work of Guldinus called the attention of a more powerful geometer to the subject. He had made some objections to the theory of indivisibles of Cavalieri, to which the latter replied, in the third of his 'Exercitationes,' and ended his reply by making the method of indivisibles furnish the demonstration which Guldinus was not able to find. It is therefore to Cavalieri, and not to Guldinus, that the credit is due of having made the first advance upon Pappus.

GULF. [BAY.]

GULF STREAM. [ATLANTIC OCEAN.]

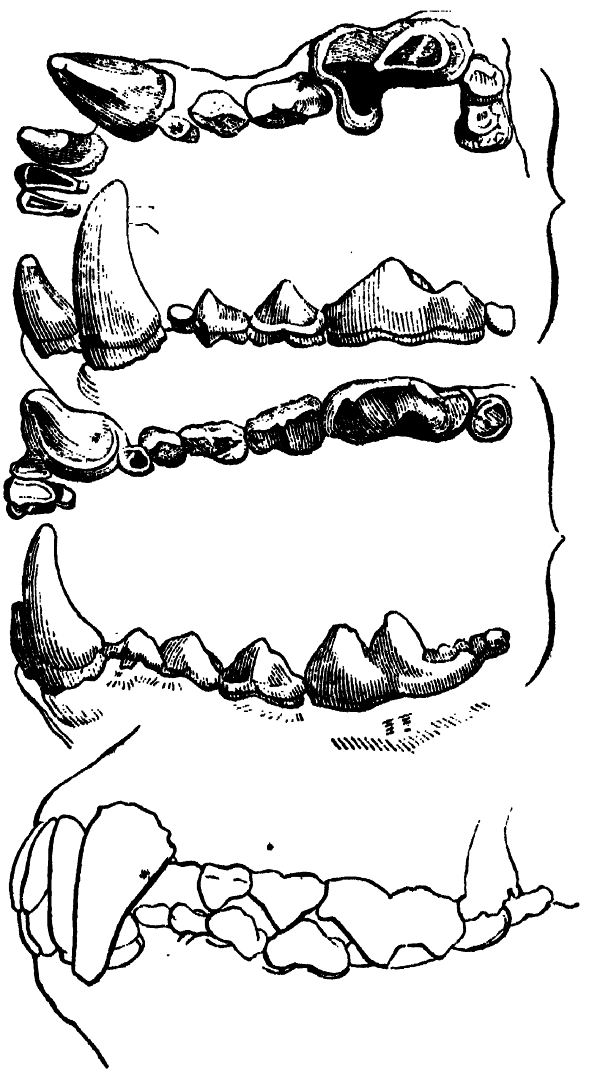
GULL. [LARIDÆ.]

GULO, the generic name under which the *Glutton*, or *Wolverene*, and the *Grison* (Galictis of Bell), with other carnivorous congeners, have been arranged.

M. F. Cuvier, in the 32nd number of his 'Dents des Mammifères,' says that he might have treated of the *Grison*, the *Tayra* (Gulo barbatus of Desmarest), and the *Glutton*, in his preceding article, where he treats of the dentition of the *Putois* (Putorius of G. Cuvier), *Zorille* (Zorilla), and *Martes* (Martens); for, he remarks, the dental arrangement of the *Grison* and *Tayra* resemble that of *Putorius*, and that of the *Grison* is similar to the formula observed in *Martes*. The two first, he states, have two false molars above and three below, and the last has an additional one in each jaw. For the rest, these animals have nothing in their teeth to distinguish them; that is to say, he continues, they have the same incisives, the same canines, and the same tubercular teeth. They have consequently all a relish for blood, and could not be separated from each other, were it not for the plantigrade feet of the *Grison*, the *Tayra*, and the *Glutton*, an organization which does not however change their propensities, and only leads to the modification of the means by which they satisfy their appetites.

The dental formula of the group has been stated as—

Incisives $\frac{6}{6}$, Canines $\frac{1-1}{1-1}$, Molars $\frac{4-4}{5-5}$ or $\frac{5-5}{6-6}=34$ or 38



Teeth of Gulo. (F. Cuvier.)

The well-developed carnivorous dentition, united with the plantigrade foot, seems to have thrown a difficulty in the way of zoologists, as to the proper place of these animals in a natural arrangement.

Linnæus placed the Quickhatch (*Ursus luscus*) among the Bears; but he appears to have considered the Glutton

of the Old Continent not only as a different species, but as a different form, under the name of *Mustela Gulo.* This species is preceded by the *Mustelæ lutris, lutra, lutreola,* and *barbara* (the latter the *Galera* of Brown, Jam.?); and at the end of the description of *Mustela Gulo,* Linnæus inquires whether all these species ought not to be referred to the genus *Viverra.* 'Cum fata mihi denegarint præmissas species intueri vivas, videant alii numne ad *Viverras* referri debeant; hoc suadet *Lutræ* statura; hoc *Gulonis* fœtor, scansura arborum, summa laniena.' (*Syst. Nat.*, ed. 12.)

Baron Cuvier (1817-1829) notices the position among the Bears assigned to the Glutton by Linnæus, but does not allude to its place among the *Mustelæ* of Linnæus, though he observes that the Gluttons approach more to the Martens in their dentition as well as in their general nature, while they only show their proximity to the Bears by their plantigrade feet. They have, he observes, three false molars above and one below in front of the carnivorous tooth (carnasière), and behind it a small tubercular tooth, which, in the upper-jaw, is wider than it is long. The upper carnivorous tooth has only one small internal tubercle, and this, he remarks, is very nearly the dental system of the Martens. He concludes by stating that the Gluttons are animals with a moderate tail, with a fold under it in lieu of a pouch, and in other respects resembling the Badgers in their contour.

M. F. Cuvier's views (1825) are given above.

Mr. Gray (*Annals of Philosophy,* 1825) divides the *Ursidæ*, the second of his five families of the order *Feræ*, into five subfamilies. The third of these subfamilies, which he places in his second section (tubercular grinder 1 – 1 above and below), is *Gulonina*, and consists of the genera *Gulo*, Retz; *Galera*, Brown; *Grisonia*, Gray; and *Mellivora*, Storr.

M. Lesson (1827), in his 'Manual,' arranges the genus *Gulo*, Retz, between the Badgers and the Ratel (*Mellivora*, Storr); and he gives the following definition of the genus:— 'Feet pentadactyle; two folds of skin, but no pouch near the vent; body more or less slender (effilé), more or less elevated on the legs; tail rather short.' The dental formula stated by Lesson is the same as that above given.

Dr. Fischer (1829) places *Gulo* between *Mydaus* and *Ailurus*.

Mr. Swainson, in his 'Classification of Quadrupeds' (1835), says, 'In its general appearance and physiology the otter is not unlike the ordinary polecats; and the resemblance is still further strengthened by the latter having semi-palmated or half-webbed toes, and occasionally frequenting the water in search of fish. On the other hand, the grisson (grison), *Gulo vittata* (vittatus), and the taira, *G. barbara* (barbarus), now placed among the gluttons, have their feet also semi-palmated; and, observes M. Cuvier, it appears they have sometimes been mistaken for otters. We may thus terminate the series of the *Mustelinæ* with the genus *Gulo*, which, although plantigrade, appears to have an affinity to the polecats through *Lutra*, while at the same time it may open a passage to the badgers and bears.' In the same page Mr. Swainson writes, 'It will be a question for future investigation whether the gluttons, *Gulo*, the rattels (ratels), *Ratelus*, and the badgers, *Meles*, form the aberrant portion of the ursine circle, or whether they merely represent the bears, and enter into the circle of the *Mustelidæ*. For the present we may consider the two last in the former light, and thus pass onward to the subfamily of *Ursinæ*, typically distinguished from all others of the *Mustelidæ* by their great size, their omnivorous diet, and their short tails.' In the third part of the work, 'the class Mammalia arranged according to its natural affinities,' *Gulo* is placed among the *Mustelinæ*, a subfamily which is preceded by '*Viverinæ*' (Viverrinæ?) and followed by *Ursinæ*.

The species of *Gulo* noted by Cuvier are: 1. The Glutton (*Ursus Gulo*, not of Linnæus, as Cuvier quotes it, but of Pallas and Gmelin) of the Old Continent, which, Cuvier observes, does not appear to differ from the Glutton of North America (*Ursus luscus* of Linnæus); 2. The Grison, (*Viverra vittata*, not, as Cuvier quotes it, of Linnæus, who has no such species of *Viverra* in his last edition of the 'Systema Naturæ,' but of Gmelin); and 3. The Taira, or Tayra (*Mustela barbara* of Linnæus).

Lesson admits the following species of *Gulones*:—*G. arcticus* of Desmarest; *Ursus Gulo*, Linn. (Gmel.), &c., the Glutton, with *Ursus luscus*, Linn., as a variety; *G. vittatus* of Desmarest; *Viverra vittata*, Linn. (Gmel.), &c., the Grison; *G. barbatus* of Desmarest; *Mustela barbata* (*barbara*), Linn.; the Taïra, or Galera, *Grand Furet* of D'Azara; and *G. orientalis* of Horsfield, *Nientek* of the Javanese.

Dr. Fischer makes the recent species consist of *G. arcticus*, Desm., *G. vittatus*, Desm., *G. barbatus*, Desm., **G. lanatus* and *G. Capensis*, Desm. (the Ratel), observing that this last would be better removed to a distinct genus, and making this general remark on the whole generic assemblage,—'Genus e speciebus nimis heterogeneis uti videtur conflatum.' In his addenda he introduces *G. larvatus*, Temm. and Hamilton Smith, and *G. ferrugineus*, Hamilton Smith.

The Grison has been separated into a genus, named *Galictis*, by Mr. Bell, and *Grisonia* by Mr. Gray, who also distinguishes the Tayra generically under the name of *Galera*, Brown, and observes, on the occasion of defining his genus *Helictis* (*Zool. Proc.*, 1831), that the *Gulo orientalis* of Dr. Horsfield's 'Zoological Researches in Java' appears to him to form a second species of the genus.

Pallas, and, after him, Pennant, who both arranged the form among the Bears, treat the Glutton of the Old and that of the New Continent as identical; and indeed zoologists seem now to agree in coming to that conclusion, but the synonyms afford good evidence of the difference of opinion that has prevailed with regard to its proper position.

The Glutton, *Gulo luscus*, is the *Carcajou* of La Hontan and the French Canadians, *Quickhatch* (*Ursulo affinis Americana*) of Catesby (Carolina), *Quickehatch* of the English residents at Hudson's Bay, *Quickhatch*, or *Wolverene*, of Ellis, *Wolverene* of Pennant, *Wolverin*, *Quiquihatch*, or *Carcajou*, of Graham (MSS.), *Kablee-arioo* of the Esquimaux of Melville Peninsula, *Kă ĕ wĕĕk* of the Esquimaux of Boothia Felix, *Naghai-eh* of the Chippeways, *Ommeethatsees*, *Okeecoohagew*, and *Okeecoohawgees* (whence, as Dr. Richardson observes, the term Quickehatch of the European labourers in the service of the Hudson's Bay Company is evidently derived) of the Crees, or Algonquins, *Rosomak* of the Russians, *Jarf*, *Filfress* of the 'Fauna Suecica,' *Timmi* of the Kamtchatkans, *Haeppi* of the Koratzki, *Glouton* of the French, *Gulo* of Olaus Magnus, *Gulo*, *Vielfrass* of Gesner, *Hyæna* and *Ursus Freti Hudsonis* of Brisson, *Mustela Gulo* and *Ursus luscus* of Linnæus, *Ursus Gulo* of Pallas and Gmelin, *Taxus Gulo* of Tiedemann, *Gulo arcticus* of Desmarest, *Gulo vulgaris* of Griffith's Cuvier, *Gulo luscus* of Sabine.

Habits, Food, &c.—Olaus Magnus seems to have been the source whence most succeeding writers have drawn their marvellous accounts of the Glutton, setting forth its cruel and destructive powers, its inordinate voracity, and the means which it adopts for filling itself till it is ready to burst, and for getting rid of the load which it has swallowed. Buffon, who, too prone to censure other writers, and even nature herself, appears to have had almost the appetite of a Pliny for every wonderful tale, eloquently presents the relations of the older writers, not forgetting Ysbrandt, describing the Glutton as a ferocious animal, prompt to attack the larger quadrupeds, and even fearlessly approaching man. He tells us that the wily beast supplies the want of swiftness by the extraordinary degree of cunning which it manifests in surprising its prey; he relates how it will climb a tree, and there lie in ambush for the elk and the reindeer, pouncing on their backs as they pass unsuspiciously beneath, and adhering so firmly by its claws, that all efforts to dislodge the grim rider by the tortured and terrified animal are vain. Nor is this all; it is said even to bait the ground by throwing down the moss which is so favourite a morsel with the reindeer, to lure that animal to its destruction. So much for legends. Turn we now to the accounts of actual observers. Dr. Richardson remarks that this character of the Glutton seems to be entirely fictitious, and to have partly originated in the name of 'Glutton' having been given occasionally to lynxes and sloths, adding, after recapitulating it, that it is very dissimilar to the habits of the American wolverene.

Buffon's name of the 'Quadruped Vulture,' as applicable to the Glutton, has more foundation in fact, for it appears to prey occasionally at least upon the dead bodies of quadrupeds; but so much cannot be said for his repetition of the assertion that the beast will approach man without fear, —unless, indeed, it is sorely pressed by hunger.

Dr. Richardson states that the wolverene feeds chiefly

upon the carcases of beasts which have been killed by accident, that it has great strength, and that it annoys the natives by destroying their hoards of provision, and demolishing their marten traps.

Mr. Graham in his MSS. informs us that the wolverenes are extremely mischievous, and that they do more damage to the small-fur trade than all the other animals conjointly. They will, he states, follow the marten-hunter's path round a line of traps extending forty, fifty, or sixty miles, and render the whole unserviceable, merely to come at the baits, which are generally the head of a partridge or a bit of dried venison. They are not fond of the martens themselves, but never fail of tearing them in pieces or of burying them in the snow by the side of the path, at a considerable distance from the trap. Drifts of snow often conceal the repositories thus made of the martens at the expense of the hunter, in which case they furnish a regale for the hungry fox, whose sagacious nostril guides him unerringly to the spot; and two or three foxes are often seen following the wolverene for this purpose.

Such is Mr. Graham's interesting and, we believe, faithful account of the habits of the wolverene. May not the attendant foxes have given rise to the story that the Arctic fox is the jackal, or provider of the glutton?

Dr. Richardson says of the glutton, 'It is so suspicious, that it will rarely enter a trap itself, but beginning behind, pulls it to pieces, scatters the logs of which it is built, and then carries off the bait. It feeds also on meadow mice, marmots, and other rodentia, and occasionally on disabled quadrupeds of a larger size. I have seen one chasing an American hare, which was at the same time harassed by a snowy owl. It resembles the bear in its gait, and is not fleet; but it is very industrious, and no doubt feeds well, as it is generally fat. It is much abroad in the winter, and the track of its journey in a single night may be often traced for many miles. From the shortness of its legs, it makes its way through loose snow with difficulty, but when it falls upon the beaten track of a marten-trapper, it will pursue it for a long way.' (*Fauna Boreali Americana.*) The same author (*loc. cit.*) remarks that the wolverene is said to be a great destroyer of beavers, but that it must be only in summer, when those industrious animals are at work on land that it can surprise them; for an attempt to break open their house in winter, even supposing it possible for the claws of a wolverene to penetrate the thick mud-walls when frozen as hard as stone, would only have the effect of driving the beavers into the water to seek for shelter in their vaults on the borders of the dam. Dr. Richardson further tells us that though the wolverene is reported to defend itself with boldness and success against the attack of other quadrupeds, it flies from the face of man, and makes but a poor fight with a hunter, who requires no other arms than a stick to kill it.

Captain James Ross (*Appendix* to Sir John Ross's Last Voyage) gives a striking narrative of the boldness of the species when urged by famine. The incident happened at Victoria Harbour. 'There,' writes the gallant Captain, 'in the middle of the winter, two or three months before we abandoned the ship, we were one day surprised by a visit from one, which, pressed hard by hunger, had climbed the snow-wall that surrounded our vessel, and came boldly on deck, where our crew were walking for exercise. Undismayed at the presence of twelve or fourteen men, he seized upon a canister which had some meat in it, and was in so ravenous a state that whilst busily engaged at his feast he suffered me to pass a noose over his head, by which he was immediately secured and strangled. By discharging the contents of two secretory organs, it emitted a most insupportable stench. These secretory vessels are about the size of a walnut, and discharge a fluid of a yellowish-brown colour, and of the consistence of honey, by the rectum, when hard pressed by its enemies.'

The wolverene produces young once a year, in number from two to four, and the cubs are covered with a downy fur of a pale cream colour. (Richardson.)

Geographical Distribution.—Throughout the whole northern parts of the American Continent, from the coast of Labrador and Davis's Straits to the shores of the Pacific and the islands of Alaska. It even visits the islands of the Polar Sea, its bones having been found in Melville Island, nearly in latitude 75°. Not rare in Canada. Extent of range to the southward not mentioned by American writers. (Richardson.)

Captain James Ross (*Appendix* above quoted) remarks that some traces of the existence of the wolverene in the highest northern latitudes were observed on two of the preceding Arctic expeditions: but none of the animals were seen on those occasions; although, he observes, we know that it remains throughout the winter as far north as 70° N. lat., and is not, like other animals of that rigorous climate, subject to any change of colour from the intense cold. A few days previous to the arrival of the Esquimaux near Felix Harbour, in January, 1830, the tracks of this animal were first seen; and soon after the skins of two old and two young ones were brought to the ship by the natives, who had taken them in traps built of stone. During each of the following winters their tracks were occasionally seen, and at Victoria Harbour they were very numerous.

Pennant notes it as inhabiting Lapland, the northern and eastern parts of Siberia, and Kamtchatka.

Lesson states that it inhabits a complete circle round the north pole, in Europe and Asia, as well as America.

Utility to Man.—We have seen what mischief the Glutton does to the trapper, and the skin of the animal does not compensate for its destructive habits. Pennant says that the skin sold in Siberia for four or six shillings; at Yakutsk for twelve; and still dearer in Kamtchatka, where the women dress their hair with its white paws, which they reckon a great ornament. The fur, he adds, is greatly esteemed in Europe, and he remarks that the skins of the north of Europe and Asia, which are sometimes to be seen in the furriers' shops, are infinitely finer, blacker, and more glossy than those from America. Dr. Richardson says that the fur of the American Glutton bears a great similarity to that of the black bear, but that it is not so long nor of so much value.

Description.—*Head* broad and compact, suddenly rounded off on every side to form the nose. *Jaws* resembling those of a dog in shape. *Back* arched; *tail* low and bushy; *legs* thick and short: whole aspect indicating strength without much activity. *Fur* generally dark brown, passing in the height of winter almost into black. A pale reddish brown band, more or less distinct, and sometimes fading into soiled brownish white, commences behind the shoulder, and running along the flanks turns up on the hip and unites with its fellow on the rump. The short tail thickly covered with long black hair. Some white markings, not constant in size or number, on the throat and between the fore legs. *Legs* brownish black. *Claws* strong and sharp.

Dr. Richardson, from whose work (*Fauna Boreali Americana*) the above description is taken, adds that the animal places its feet on the ground much in the manner of a bear, and imprints a track on the snow or sand, which is often mistaken for that of the bear by Europeans on their first arrival in the fur countries; but the Indians distinguish the tracks at the first glance by the length of the steps. The Doctor also gives the following dimensions:—

	ft.	
Length of head and body . .	2	6
tail (vertebræ) . .	0	7
tail with fur . .	0	10

Captain James Ross (*Appendix*, &c.) states that the descriptions of authors are sufficiently accurate, but he adds that the following dimensions of a female, which weighed 27¾ pounds may be useful:—

	inches.
Length from snout to insertion of tail	28·4
of the tail	9·8 (vert.)
of the hair of the tail . .	6
	41·2
Length from snout to shoulder . .	11·2
to occiput . .	6·5
Extreme breadth of head . . .	4·1
Circumference at ensiform cartilage .	14·5
at neck	10·6
at broadest part of the head	13

Vertebræ—Cervical	7	
Dorsal	15	(10 true and 5 false ribs)
Lumbar	5	
Sacral	3	(now in one)
Caudal	15	

The Wolverene, or Glutton (Gulo luscus).

The anatomy of the Grison, *Gulo vittatus* of Desmarest, *Viverra vittata* of Schreber and Gmelin, *Lutra vittata* of Traill, *Ursus Brasiliensis* of Thunberg, and *Galictis vittata* of Bell, has been made known to us by Mr. Martin, who, in the 'Zoological Proceedings' for 1833, states the results of the post mortem examination of a male which had been kept in the Gardens at the Regent's Park. The animal, from the nose to the insertion of the tail, measured 1 foot 6 inches, and the tail was 6½ inches in length. The intestines, as in the Mustelidæ generally, exhibited no division into small and large, except that the *rectum* became gradually increased in circumference: their total length was 4 feet 5 inches. The *stomach*, when moderately inflated, measured 10½ inches in its greatest circumference, 13 along its greater, and 4½ along its lesser curve. The *omentum* was thin and irregularly puckered together. At about 5 inches from the *anus* commenced a group of thickly crowded mucous follicles, occupying a space of 4 inches in length. The *anus* was furnished with two glands, each of the size of a nutmeg, and containing a fluid of the consistence and colour of liquid honey, and of a most intolerable odour: the orifice or duct of these glands opened just within the verge of the anus. The *liver* was tripartite, the middle portion being divided into one large and one small lobe; on the under side of the large lobe, in a deep furrow, was situated the gall-bladder, of a moderate size and somewhat elongated form. The biliary secretion entered the *duodenum* 1½ inch below the pylorus. The *pancreas* was long, flat, and narrow; beginning in a curved form near the *pylorus*, and following the course of the *duodenum* for about 4 inches. The *spleen*, tongue-shaped, was loosely attached to the stomach and 6 inches in length. The *lungs* consisted of three right and two left lobes. The *heart* was of an obtuse figure, measuring 1¼ inch in length and 1 inch in breadth. The primary branches of the *aorta* were, 1st. a right branch, or *arteria innominata*, which, running for a quarter of an inch, gave off the two carotids and the right subclavian; and, 2nd. a left branch, passing to form the right subclavian. The *epiglottis* was acuminate, and in close approximation to the *tongue*, which was tolerably smooth, with a crescent of distinct fossulate papillæ at its base. The *os hyoides* was united by a succession of four bones on each side to the skull. The *kidneys* were of an oval form, the right being half its length higher than the left: length of each 1½ inch. The *tubuli* entered the *pelvis* of the kidney by a single large conical papilla. Suprarenal glands small. The *testes* each as large as a small nutmeg; the cremaster muscle, embracing the spermatic cord as it emerges from the ring, very distinct. The *penis* had been injured in removing the skin of the animal; its length from the *pubes* was about 3½ inches, and its muscles were very distinct. It contained, as in the *Dog*, a slender bone, 1¾ inch long, rather stout at its commencement, then narrowing as it proceeded till near the *apex*, when it suddenly bent at an obtuse angle, giving off at this part two small processes. The distance of the *prostate* from the bladder was 1½ inch.

Habits, Food, &c.—The habits of the Grison are very sanguinary, and it is a great destroyer of the smaller quadrupeds.

Geographical Distribution.—Inhabits the greater part of South America, but more particularly Guyana and Paraguay. Dr. Rennger notes both it and *Gulo barbarus* among the plantigrade carnivora of Paraguay, where both species are called *Yaguape*.

Description.—*Head* rather large; ears broad and short. *Body* very much elongated; fur above deep brown, each hair tipped with white, which gives a grey or hoary aspect to the upper parts. A broad white line passing on each side of the front to the shoulders. *Nose, throat,* under side of *body, thighs,* and *legs* black. Length about 2 feet.

Grison.

There is a notice in the 'Zoological Proceedings' for 1830-31 of the exhibition of a living quadruped referrible to *Gulo barbarus*. It was presented to the Society by Edmonstone Hodgkinson, Esq., of Trinidad, who described it as being 'playful and gentle, although easily excited and very voracious. It is exceedingly strong, as is indicated by its shape; and it has the same antipathy to water as a cat.' Mr. Hodgkinson suspected it to be a native of Peru. He obtained it in Venezuela, where it was presented to him by the president, General Paez. The name he received with it was the *Guache;* but this appellation, it was observed by Mr. Bennett, was probably erroneously applied to the present animal, belonging rather to the Coati, the orthography of which is variously given as *Coati, Couati, Quasje, Quachi*, and *Guachi*. The latter form, it is remarked, occurs in the 'Personal Narrative' of the Baron Von Humboldt, where it evidently refers to a nocturnal species of *Nasua*. The form and general appearance of the animal were remarked to be altogether those of a *Mustela*, to which genus, it was observed, it should probably be referred, together with the typical *Gulo barbarus*. A specimen of the latter was placed upon the table, from which the living animal was shown to differ by the absence of the large yellow spot beneath the neck: a remarkable distinction in this group, but on the occurrence of which, unless confirmed by several specimens, it was considered improper to propose regarding it as a distinct species.

There is a figure and description of the *Galera*, referred to by Linnæus for his *Mustela barbara*, in Browne's 'Jamaica,' p. 485, tab. 49. Browne calls it the *Galera*, or *Guinea Fox*, and says that it is often brought to Jamaica from the coasts of Guinea (Guyana?), where it is a native, and frequent enough about all the negro settlements. It is, he says, of the size of a small rabbit or cat, and very strong in its fore-feet, which are much shorter than the hinder.

Mr. Gray, in the 'Zoological Proceedings' for 1830-31, founds a new genus, *Paguma*, on the *Gulo larvatus* of Hamilton Smith, *Viverra larvata* of Gray, in the 'Spicilegia Zoologica.'

FOSSIL GULONES.

Fossil Gluttons have been detected in the ossiferous caverns: *Gulo spelæus* (Goldfuss), for instance, has been found in those of Gailenreuth, and Sundwick, in Westphalia. Professor Kaup also records another extinct species, *Gulo antediluvianus* (Kaup), from the Epplesheim sand.

GUM is a proximate principle of vegetables, of more universal occurrence than any other secretion by plants. It is in reality the material generally prepared by them for their own growth and nourishment, and is at first always in a state of solution, in which condition it mostly remains so long as it is contained in the internal tissues of plants; but when it escapes to the exterior of the bark it frequently becomes thickened, and even solid and pulverizable. It is probable that it never escapes to the surface unless some wound of the bark has been made, either by disease, the punctures of insects, the agency of fungi, or by the knife. The escape of gum from plum and cherry trees may always be regarded as an indication of unhealthiness; the immediate cause of escape is the presence of a small corkscrew-like fungus termed *Naemaspora crocea.*

Gum is known in commerce only in the solid state; the term is often erroneously applied to substances which are a mixture of gum with resins, and which are properly *gum-resins*, such as ammoniacum, asafœtida, and the like, and even to substances which contain no portion of gum, such as euphorbium.

Chemical characters alone, and not physical, determine what is a gum; but even of true gums there are several varieties, chiefly distinguished by their greater or less solubility in water.

The purest gum (arabic) consists of a principle termed *arabin*, and is soluble in water, forming with it a mucilage. Other gums contain *bassorine*, either alone, or with arabin and other matters. When bassorine only is present, the specimen merely swells in water; if arabin be also present, it will dissolve, while the bassorine and other matters which are not impurities swell as before stated. The arabin is precipitated from its watery solution by alcohol, by silicate of potass, &c. When boiled with nitric acid, mucic or saclactic acid is produced.

Pure gum-arabic, which consists of about 97 per cent. of arabin, with 3 per cent. of some malates and other salts, has an ultimate constitution, according to Gay Lussac and Thénard, of

Carbon	42·23	
Hydrogen	6·93	
Oxygen	50·84	
		100·00

Berzelius mentions a trace of nitrogen, which may be present, as Pleisch found ammonia. Gum is certainly not acid, though, when moistened, it reddens litmus paper, owing to the presence of the malic and acetic acid of the malates and other salts above indicated.

Bassorine contains less carbon and more oxygen.

Most of the commercial gums are obtained by incisions made in the bark of several species of acacia growing in Arabia, India, Upper Egypt, Senegal, &c. The specimens differ considerably in colour, even when obtained from the same species. Genuine gum-arabic occurs in pieces from the size of a pea to that of a walnut, or larger, which are irregular in shape, or roundish or angular; either white, yellowish, or dark wine yellow; scarcely any odour; taste mawkish, glutinous. Sp. Gr. 1·316 to 1·482. It breaks easily into small irregular pieces; fracture uneven, vitreous; dissolves almost completely in water; 100 parts of water at 100° of Centigrade thermometer take up 19 parts of gum. The solution is almost transparent when made with cold water. Gum, when in powder, is often adulterated with starch, the presence of which is detected by tincture of iodine; or when cold water is used for the solution of the gum, the starch will remain undissolved. The mucilage made with cold water is not only purer, but keeps better, and for all purposes for which it can be used is preferable to that made with warm water, which is the common method.

Gum is highly nutritive, six ounces in twenty-four hours being deemed sufficient to sustain the life of an adult; yet it is not very easily digested when taken alone, and will often pass through the stomach nearly unchanged, if not associated with some bitter or astringent principle. This property however renders it demulcent in affections both of the throat and also of the intestines, by sheathing the membrane from air or the irritation of acrid secretions. Hence allowing a portion to dissolve slowly is often useful in common colds. Mucilage is also used to suspend many insoluble matters in water. Its agglutinating properties render it valuable in many of the arts.

GUM-RESINS are secretions of plants which are produced in the greatest quantity, and most perfectly elaborated, in warm countries. They are obtained chiefly from trees and shrubs of particular tribes of plants, rarely from herbaceous plants, except the large herbaceous umbelliferæ, which yield the fœtid gum-resins. They either exude spontaneously, or are procured by incisions of the stem and branches. When they first escape to the surface they are fluid, and of a light colour, but gradually harden, and become of a deeper hue, either by the evaporation of some of their volatile oil, or by the absorption of oxygen from the air, and the conversion of the oil into a resin. Some remain in a semi-liquid, viscid state, such as sagapenum and galbanum, which are only pulverizable in winter. Most gum-resins possess a strong odour, which in many instances is disagreeable, such as that of asafœtida, with a warm acrid taste, and by application to the skin for any considerable time they cause redness and inflammation. Owing to their composition being a mixture of gum and resin, they are not completely soluble either in water or absolute alcohol, but are perfectly dissolved in proof-spirit, which is much employed to prepare tinctures of this class of substances. The gum being soluble in water is capable for a time of holding the resinous portion suspended in water, thereby forming an emulsion, a state which permits of their administration, if used soon after being prepared; for by rest they separate. Many of them are soluble to a certain extent in acetic acid, especially when assisted by heat. The strong mineral acids char them and produce chemical changes. Many gum-resins are popularly termed balsams, a designation to which they have no title, as they do not contain benzoic acid.

Gum-resins are with difficulty soluble in the animal juices, yet, as they must be assimilated before they produce their characteristic effects, they require to be used for some time before the secretions of the body acquire their peculiar odour. They influence the secretory and excretory processes, which they rouse to continued action. They also act upon the skin as sudorifics, and more permanently than the volatile oils. They manifest their beneficial effects chiefly when the skin is cool, pale, and in a state of atony, and they can even check profuse perspiration, when this is caused by the lax state of the cutaneous tissues. They are likewise possessed of considerable antispasmodic powers and hence are much used in nervous complaints. They greatly promote digestion when the stomach is feeble owing to a defective supply of nervous energy. Their utility in the treatment of hysterical and other paroxysms is very much increased by administering them in a state which admits of ready solution in the gastric fluids; hence the acetous preparations of them are much more potent than any other form. They may be administered either by the mouth, or, in case of spasm closing the teeth, or the patient being refractory, in the form of clyster, the dose being doubled in the latter instance.

Gum-resins are likewise applied externally, owing to their rubefacient powers, in the form of liniments or plasters, in spasmodic and rheumatic affections, and also to assist in dispersing indolent tumours.

Gum-resins should be kept in cool well-closed places, to prevent the evaporation of their volatile principles.

GUM TRAGACANTH, or GUM DRAGON. [TRAGACANTH.]

GUMBINNEN. [PRUSSIA, EAST.]

GUMS. [DENTITION.]

GUN. [ARMS.]

GUN-METAL. [BRONZE.]

GUN-SHOT WOUNDS. Under this head writers on military surgery have usually considered not only all the injuries produced by cannon-balls, bullets, &c., striking against the body, but those which arise from the projection of stones, splinters of wood, and other substances broken off and thrown about by heavy balls, or by the explosion of shells, &c. We shall here include however only those produced by the shots themselves, because the others differ in no important degree from the more common contused wounds.

When a shot strikes the body it seldom produces much, if any, immediate pain; a slight pricking sensation is felt, but the wounded man becomes aware of the injury only by his inability to move the part, or by feeling a little blood trickling over the adjacent sound skin. Whole limbs are known to have been shot off without the consciousness of the individual when in the heat of action. Sometimes when discovered the injury produces but little effect on the system: the courage and intellect remain unaffected; the pulse and respiration unaltered. Most frequently however, if the injury be at all severe, it is followed by intense depression; the man becomes deadly pale, and is covered with profuse sweat; he trembles, and imagines death instantly at hand; he has shivering, nausea, and sickness, and remains unconscious of pain from his wound, a sign always to be regarded with apprehension. These symptoms may soon subside if stimuli be given, but if they continue unabated for some hours they afford strong reason to fear that some important organ has been deeply injured. If the heart or the brain be struck the man is often seen to leap from the ranks into the air and fall at once dead.

A part may suffer seriously from a shot without the skin being injured. These cases were long considered by surgeons (as they are still popularly) to be owing to the wind of the ball, that is, to the impulse of the air, set in motion and compressed by its swift passage. But the only portion of the air that could act on the body is that on one side of the ball, and this would not have much force outwards; besides the small part of the atmosphere by the side of the ball being compressed in only one direction, while all around it is free and moveable, could not acquire that degree of density necessary to produce such effects as were attributed to it. But still more certain proof that the air moved by the ball is altogether harmless, is afforded by numerous cases in which portions of dress are shot off without the parts beneath being injured. Dr. Thomson saw, after the battle of Waterloo, a man who had the tip of his nose carried off by a cannon ball, without any further inconvenience; and another whose external ear was shot away, and his hearing not at all affected. Vacher also saw a man between whose legs a cannon ball had passed, grazing one, and carrying off a piece of the trowsers over the other, but producing no bruise whatever. In the same manner, when a limb is shot off, the parts above the wound are but slightly injured. The real cause of this kind of injuries is, that the ball, whose force has perhaps been somewhat spent by the obstacles it has previously met with, strikes the part obliquely, and therefore with only a small part of its surface, so that the force applied is not sufficient to break through the skin, which is not only remarkably tough and elastic, but being placed on soft tissues which serve it as a kind of cushion, will yield considerably without tearing, and thus slant the ball off in another direction. The muscles and other tissues beneath it however being compressed between the ball and the bones, are more or less broken; there may be only a common bruise produced, but frequently the parts are found completely disorganized, broken up into a pulp with the blood effused from the vessels (often of considerable size) that have been ruptured, and sometimes even the adjacent bones are split and broken into fragments. If the ball has struck the head, or chest, or abdomen, the organs they contain may be ruptured, and give rise to such hemorrhage or effusion of their contents as may be rapidly fatal. It was in such cases as these, when men were found lying dead in the field without any external mark of injury, that it was supposed they were suffocated by the ball passing rapidly before their mouths. If the ball penetrates the skin, a ragged opening with its edges inverted, and appearing somewhat smaller than the ball itself is seen where it entered. The part around has a bluish or black colour from the bruise, and the cellular tissue in the track is seen black and dead. If it has struck a part perpendicularly, the ball will most likely enter into it straight; but if it have struck obliquely, it may be altogether slanted off, as in the preceding cases, or at least its course through the skin will be made more oblique, so that it will fall on the subjacent muscles at a still more acute angle than it did on the surface of the body. Its force too being somewhat expended, it will be the less likely to penetrate the dense fascia which usually covers them; and hence it is often found to have run for a considerable distance beneath the skin, till its force is completely spent, or till, meeting with a greater obstacle to its course onwards than outwards, it passes through the skin again, at a part considerably distant from that at which it entered. Some most remarkable cases of circuitous passages thus produced are recorded. Dr. Hennen mentions one in which a ball entered at the pomum Adami, ran completely round the neck, and was found close by the aperture at which it had penetrated; and another in which a ball struck the middle of a soldier's arm as he was climbing up a scaling-ladder, passed along the limb, over the back part of the chest, coursed among the abdominal muscles, dipped deep in the buttock, and presented at about the middle of the thigh, on the opposite side to that which it first struck. Sir C. Bell saw two cases in each of which there was one hole in the back, and another above the breast, so that externally they looked almost exactly alike; but in one case the ball, having struck obliquely, went up over the shoulder, and thence down to the breast, while in the other it had struck perpendicularly, and had gone straight through the chest. If the ball should penetrate the muscles, each layer that it meets with will render its course more oblique, till striking on the bone it may run for some distance along its surface. If it strikes very obliquely against the walls of a cavity, as the head, chest, or abdomen, its force may be so much expended in passing through them, that it may run for some distance along their concave internal surface, unable to penetrate the organs contained in them; as in cases mentioned by Dr. Hennen, where balls coursed between the peritoneum and intestines, and in one instance half round the chest between the lung and the concave surface of the walls. Similar cases are seen when the ball striking very obliquely does not penetrate at all, but runs for some way, even on a concave surface, between the dress and the skin, which it marks by only a slight graze. In these long or circuitous tracks, if the ball have run deep, there will be nothing to indicate the situation at which it has stopped; but when it has passed near the skin, its course will be marked by a dull blush or dusky line, or a slight wheal. If it has passed directly into a limb, the most common situation for it to be found in is immediately beneath the skin on the opposite side; if it strike a bone, it is more likely to be arrested by its cancellous than by its compact tissue; often on passing through either its further course is prevented by the tough resisting tissue of ligaments. In almost all cases in which the ball has penetrated without passing through any part of the body, some foreign substance will be found in the track of the wound; either the shot alone, or with it portions of clothing, of the contents of the pockets, or cartridge boxes, or even (as in cases given by Dr. Hennen) of the bones of some other person whom the ball had before struck and brought along with it. Sometimes the portion of clothing carried before the ball is not perforated, but driven inwards in the form of a cul-de-sac, which may be drawn out again with the ball in it. Such a case is related where in an attempt at suicide a man fired a pistol close by the side of his head; the ball passed some depth into the brain, carrying the side of his night-cap before it, so that on taking it off the portion forced into the skull drew out the ball.

When the ball passes quite through the part, the aperture by which it makes its exit has characters just the reverse of those which we have mentioned as belonging to that by which it entered. Its edges are everted, it looks somewhat larger than the ball, and it is less bruised. In these cases no foreign body may be found in the track of the wound, which is generally less circuitous than in the preceding class. Sometimes the ball is split by striking against the sharp edge of a bone, or obliquely on its surface; and then, while one piece passes out the other may run in any other direction among the tissues, where its presence is not likely to be suspected.

Lastly, a part of the surface, or of the whole substance of a limb, or of the trunk, may be completely shot off, either by one large ball, or by a whole charge of small shot. The surface thus left is uneven, ragged, and bruised, the vessels and nerves lie exposed, or hanging out, the bone protrudes, and is often split up, even to the next joint.

In all cases in which the ball has penetrated, the parts with which it has come in contact are so much injured that their vitality is destroyed, and sloughing to a greater or less depth ensues; to a greater distance around also all the tissues are severely bruised. The part divided presents a torn uneven surface; the vessels roughly rent across generally contract and close so that but little blood is lost at first; if a nerve be divided, unusual pain is produced, and

the part is paralyzed; if a bone is struck, it splinters, especially in the longitudinal direction, and is besides so shaken that death ensues in it, as in the softer tissues: after penetrating part of a bone, the ball often loses so much of its power that it remains firmly impacted in the medullary canal. If any of the cavities be penetrated, it is indicated by effusion of their contents, and other peculiar symptoms, as in the lungs by spitting up of frothy blood, extreme dyspnœa, air passing through the wound, and sometimes emphysema; in the abdomen, by protrusion of the viscera, passage of bile, fæcal matter, &c., into the cavity, producing at first extreme depression, followed by intense peritonitis.

The first process for the repair of the injury which gunshots have occasioned is the separation of the slough or dead portion around the track of the ball. As in similar cases from common causes, the inflammation necessary for this purpose supervenes but slowly, though when established it is very intense, accompanied with great swelling, heat and pain of all the surrounding parts, and severe constitutional disturbance, fever, sleeplessness, disordered stomach, &c. As the slough separates and protrudes at the orifices of the wound, these (when double) present appearances just the reverse of those which they had when first made; that at which the ball entered (then the smallest) is now the largest, its edges are wide open, and it is generally filled with a large piece of sloughed tissue hanging from it, like tow dipped in pus; while that at which the ball passed out is contracting, or has been already healed by the first intention. This difference depends on the ball having lost much of its velocity in passing through the several tissues: hence the part last traversed is less bruised or destroyed; and if, as is often the case, the ball has been flattened in its course, it may have passed out with its sharp edge forwards, and given the latter part of the track so much the character of a common penetrating wound, that it might heal by the first intention. The constitutional symptoms change when suppuration is fairly established, the surrounding inflammation is lessened, the fever subsides, and in slight injuries the health may seem but little affected. In more severe ones, where, with considerable loss of substance, a very copious suppuration occurs, or where it involves some important tissue, as a joint or bone, &c., hectic fever supervenes, with debility, a small rapid pulse, speedy emaciation, copious night-sweats, diarrhœa, &c. A chief danger accompanying the separation of the slough is that some of the large vessels, which, when torn by the ball, did not bleed much, if at all, may now ulcerate, and produce severe hemorrhage; but if this be avoided, the further progress of the wound presents nothing that could distinguish it from one of the same extent produced by any penetrating instrument, and in process of being filled up by granulations.

Gun-shot wounds partake of the natures at once of penetrating, lacerated, and contused wounds, and they present the characters of all these in an extreme degree of intensity, from the velocity with which the ball, ill fitted by its shape for penetrating, has been propelled. The general rules of treatment must however be the same as for similar injuries from common causes, but it will be advisable here to notice a few points peculiar to this class alone, and to point out what, after long discussions, are now the most generally received rules of practice.

The extraction of the ball and other foreign substances, though its necessity has been very much exaggerated, is first to be considered. If, on examination of the wound (which should be made as much as possible with the finger), the ball and the substances it has carried in with it be felt tolerably movable, and in a part where forceps can be easily applied, they should certainly be at once extracted, and sometimes, though very rarely, it may be advisable even to dilate the wound by incisions along its sides for this purpose. No violent attempts should ever be made at first to accomplish the removal; for as the walls of the wound slough and suppurate, the track will become larger, and they may then either fall out or be easily displaced, or they may sink down, and presenting at a dependent part, may be taken out after merely dividing the skin over them; or they may become imbedded in the surrounding tissues, and as the irritation at first produced subsides, the adhesive inflammation may form a loose sac around, in which they may lie for years, without producing any further inconvenience.

It has been already said that the ball may pass through a part, and lodge just beneath the skin of the opposite side, or that after a circuitous course it may be found under the skin at a distance. In either case, if it can be felt, even at the distance of an inch below the surface, it should be cut down upon and removed. If it strike against a bone, it may lodge in it superficially, and may then be displaced with the forceps, or with the end of a scoop, or, if more deeply fixed, with a bullet-screw: if it pass through its wall into the cancellous texture, many surgeons recommend that the bone should be cut down upon, and a trephine applied over the ball, so as to cut out a piece of bone sufficiently large to draw it through. If the ball or other substances be not extracted at first, and remain fixed after the sloughing and suppuration, no further attempt to remove them should be made till the inflammation that has supervened is fairly subdued: then, if much irritation continues to be excited, if abscesses form about its track, and much constitutional disturbance is produced, it may be necessary to use every effort to find out their seat, and if possible remove them; but if still impracticable, and amputation cannot be performed, or is not deemed advisable, the future treatment must consist in supporting the patient by tonic and anodyne medicines, and by the mildest antiphlogistic local applications.

Whether the ball be extracted or not, the simplest possible dressings should be at first applied; a piece of linen spread with some mild ointment, fixed on lightly by strips of adhesive-plaster, and covered by a rag kept constantly moist with cold water, are the best and most comfortable applications. Tight bandages, stimulating and heating ointments, &c., are especially injurious. It may be frequently advisable to bleed the patient immediately, or soon after the accident, and aperient medicine should always be given, and a mild antiphlogistic diet strictly enjoined. After three or four days, when suppuration is established, the cold application will probably cease to be agreeable to the patient, and then it should be exchanged for some warm emollient poultice (either of bread, or carrots, or turnips, or marsh-mallows, or any mild vegetable most conveniently at hand), and the constitutional disorder altering with the condition of the sore, the reducing remedies may be laid aside, and soon replaced by mild tonics, a nutritious diet, &c.

The question of amputation, when that operation is applicable, must be decided as in common cases by the character of each; no general rule can be given, except that, *cæteris paribus*, it will be advisable in many cases in military practice, in which, in civil practice, it would be scarcely justifiable. If the difficulty of removal from the field to any permanent hospital, the insufficiency of accommodation and nursing which must be experienced where large numbers are simultaneously wounded, the badness of the air to which they will probably be exposed in crowded barracks, and other circumstances inseparable from the movements and arrangements of large military or naval forces, be considered, it will be evident that it would be advantageous to convert a severe wound, contused and lacerated, which even under the most favourable circumstances would be uncertain and most tedious in its progress, into a clean incised one like that of an amputation, in which danger from bleeding may be lessened and which will require far less attention than the other. As to the long-debated question, at what time amputation should be performed, it is now agreed, that the best period is as soon as possible after the patient has recovered from the immediate depressing effects which often follow the reception of the wound.

Wounds of the head, chest, and abdomen must be treated as in common cases: if the ball be lodged in these cavities, it will be improper to use more than the most gentle means to extract it; and if in the abdomen, it will generally be quite useless to search for it. The most vigorous antiphlogistic treatment will be necessary to give the patient a chance of recovery.

Secondary hemorrhage not unfrequently ensues, when the parts around the track of the wound slough by ulceration of the larger vessels injured by the ball. The bleeding vessel must, if possible in this case, as well as if it is observed at the first receipt of the injury, be at once cut down upon and tied both above and below the opening. In the same way portions of various organs may slough from the injuries received and by giving issue to their contents may produce rapidly fatal symptoms.

In cases where the skin is not injured, but the parts beneath greatly bruised, it is recommended to make one or more incisions in order to clear out some of the coagulated blood, &c., and to permit the discharge of the sloughs.

Where the bones and vessels are considerably broken, as sometimes happens in these cases, amputation is at once necessary. In all cases when the sloughs have separated the wound commences to granulate, and from this time, whether its progress be towards recovery or death, its treatment need not differ from that of wounds in a similar condition from common causes.

(John Hunter, *Treatise on the Blood, Inflammation, and Gun-shot Wounds*, 'Works,' by Palmer, vol. iii., 1837; Larrey, *Mémoires de Chirurgie Militaire*, 4 vols. 8vo., 1812; Guthrie, *On Gun-shot Wounds of the Extremities*, 1 vol. 8vo., 1815; John Hennen, *Observations on some Important Points of Military Surgery*, 1 vol. 8vo., 1818.)

GUNDUCK, or GONDOCK. [HINDUSTAN.]

GUNNERY is that branch of the art of war which comprehends the theory of military projectiles, and the manner of employing ordnance in the attack and defence of fortresses or positions.

The first application of gunpowder to the purpose of discharging balls from cannon appears to have been about the year 1366; when it is said that some Germans brought to the Venetians, who were then besieging Claudiafossa, a town now called Chioggia, two small pieces of artillery with a supply of powder and leaden-balls, by the aid of which they soon made themselves masters of the place. The discovery of the composition is supposed to have been made by Schwartz about 30 years previously. It should be observed however that Roger Bacon described, in 1270, a composition of the same nature, and that both the Hindus and Chinese are supposed to have used it at a much earlier epoch. [BACON, ROGER; GUNPOWDER.]

For descriptions of some of the oldest cannons the reader is referred to the word ARTILLERY. Representations of the forms of many antient pieces of ordnance may be seen in the 'Treatise on Artillery,' by Diego Ufano, 1614, as well as in the *Prattica Manuale di Artiglieria*, by Luigi Colliado, 1606. Generally the antient fire-arms were so constructed as to discharge masses of enormous weight; and it is said that when Mohammed II. besieged Constantinople he employed pieces whose calibre (diameter of bore) was equal to 12 palms, and which projected against the walls of the city stones weighing 1200 lbs. At present a rapid succession of discharges from a comparatively small kind of ordnance is considered more efficacious, when directed against the walls of a fortress, than the few shots which can be fired from such unwieldy machines. The 13-inch shell which is now employed weighs, when loaded, about 200 lbs.; but when the French besieged the citadel of Antwerp in 1832, the Belgians brought up a mortar whose calibre was 24 inches, and whose shell when loaded weighed 1015 lbs. The effect produced by it was not however so great as had been anticipated.

Tartalea appears to have been the first mathematician who wrote on the motion of balls when projected from fire-arms, and in his *Quesiti et Inventione Diversi*, which was printed at Venice in 1546, he investigates a few particulars concerning that kind of motion; but the low state of the theory of such motions at that time may be imagined, when we consider that he thought it necessary to disprove the opinion, which then prevailed, that one part of the trajectory, or path, of a cannon-ball was rectilinear.

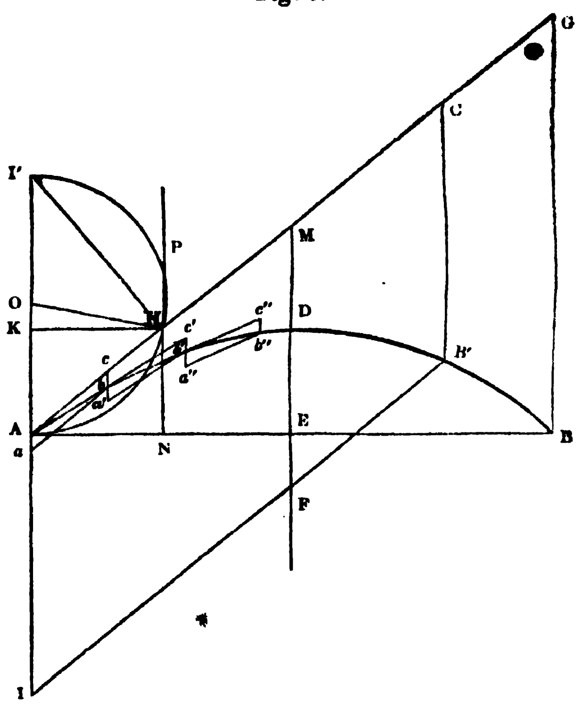
In 1638 Galileo published the *Dialoghi delle Scienze Nuove*, in which, together with his investigations concerning the composition of motions in general, he shows that a shot projected from a gun describes a parabolic curve. He states that the shot is urged by the impulsive force of the powder in a rectilinear direction, coinciding with the axis of the bore, and that it would move with a uniform velocity if it were not continually deflected by the attraction of gravity from that direction; he shows also that this deflecting force, exerted in lines perpendicular to the horizon, would cause the shot to descend in such lines with a variable velocity. Now, the spaces which would be described in consequence of the projectile force, being proportional to the times of describing them; and the spaces described in consequence of the earth's attraction being proportional to the squares of the times; it followed, from the relation between the spaces so described, that the shot, which, according to the laws of the composition of motions would always be at the intersection of the lines representing the spaces, must describe a curve with respect to which the corresponding lines would have the same relation; that is, a parabola.

Galileo expressly says that this curve would be described by the shot, if it were not resisted by the air; he was aware of that resistance, and he proposes a method of finding its effects. It is now well known that the resistance of the air, when the motion of the projectile is rapid, is such as to cause the latter to describe a curve-line very different from a parabola; and consequently that the parabolic theory, as it is called, is of small importance as a guide to the practical artillerist; yet as it possesses a certain interest on account of its connexion with the general subject of projectiles, and is a step to the investigation of the real trajectory, it will be proper, before entering upon that investigation, to give a demonstration of the fundamental proposition, and exhibit a few of the principal deductions which are usually made from it.

In proving that the path of the shot in vacuo is a parabolic curve, we may be permitted, agreeably to the method used by Newton in treating the subject of curvilinear motion, to consider the trajectory as consisting of a series of right lines described in successive intervals of time, and constituting the diagonals of parallelograms formed in a vertical plane between the vertical deflections caused by gravity and the production of the line of motion which had been described in each preceding interval of time. Then, if the intervals of time be supposed infinitely small, it is evident that the trajectory may be considered as a curve line.

Now let AB, *fig.* 1, represent a horizontal line on the

Fig. 1.



ground, and AG the produced axis of the gun at A; then, if A*c* be taken on AG to represent the space which the shot would describe in that direction by the force of the powder in a small portion of time, and A*a*, or *cb*, the space through which the shot would descend by gravity in the same time; by the theory of the composition of motions the shot would describe the diagonal A*b* in the same time, and A*b* may be taken to represent the velocity at *b* in the path. Producing A*b* and making *bc'* equal to A*b*, the line *bc'* will represent the space which would be described by the shot in an interval of time equal to the former, if the action of gravity were to cease; then if we make *ba'*, or *c'b'*, equal to A*a*, to represent the deflection caused by gravity in this next interval of time, the shot would evidently describe the line *bb'* in the same time; and this would represent the velocity in the path at the end of the second interval. Therefore, producing *bb'*, making *b'c''* equal to *bb'*, and proceeding as before, we should have a series of points A, *b*, *b'*, *b''*, &c., in the path of the shot; which, being considered as a curve, the several lines A*c*, *bc'*, *b'c''*, &c., would become tangents at those points.

On account of the equality of the lines A*b* and *bc'*, *bb'* and *b'c''*, &c., respectively, it is evident that the parallel

vertical lines passing through A, b, b', b'', &c., will be equally distant from each other; and, as the deflections which are produced by the action of gravity in equal times are equal to each other, we have also cb, $c'b'$, $c''b''$ equal to each other, which is a known property of the parabola. And thus the trajectory of the shot is proved to be that species of curve.

In determining the circumstances relating to the motion of projectiles, it is usual to represent the initial velocity of the shot by that which a body would acquire by falling, in vacuo, from a state of rest during a certain time. Let therefore a vertical line AI, or AI′, be drawn through A, and equal in length to the space through which a body would descend by gravity in the time necessary to acquire a velocity equal to that with which the shot is discharged, from the piece of ordnance at A, in the direction AG; then, by the laws of motion the shot, moving uniformly, would describe AC, a space equal to 2AI, in the time of the said descent from A to I. Therefore, drawing IB′ parallel to AG till it meets the vertical line drawn from C, the intersection B′ will be the place of the shot in the curve at the end of the same time, reckoned from the moment of the discharge. This line AI, or I′A, is technically called the impetus, and AB the range of the projectile.

Since IB′, or AC, is equal to 2AI, by a property of the parabola, IB′ is equal to half the parameter of the diameter AI; and if AB were bisected in E, the intersection F of this line with one drawn through E perpendicularly to AB would be the focus of the curve. The line passing through E and F is the axis of the parabola, which is symmetrical on each side of this line, and the extremity D of the latter is the highest point of the trajectory. If the angle BAC, of elevation, were equal to 45°, the line IB′ would pass through E, the middle point of the horizontal line AB; E would then become the focus; the range AB would be equal to the parameter of the axis, and the height ED would be one-fourth of the range.

On account of the equality of the distances in directions parallel to AB, between the vertical lines passing through A, b, b', b'', &c., it will follow that the velocity of the shot, if estimated in a direction parallel to the horizon, will be the same at every point in the trajectory; for the equal intervals parallel to AB, between those verticals, are decomposed parts of the tangential spaces Ab, bc', $b'c''$, &c., which by hypothesis are described in equal times, and consequently may represent the velocities at A, b, b', b'', &c., in the directions of tangents to the trajectory.

With respect to the velocity in a vertical direction at any point of the curve, it may be determined by considering that the spaces Aa, ba', &c., are described by gravity in the same times as the spaces Ac, bc', &c., are described by the projectile force. Now, by the laws of gravity, considered as a uniformly accelerative force, a body descending through a space, as ba', would acquire a velocity which would carry it with a uniform motion through a space equal to $2ba'$ in the same time; and as the spaces described with uniform motions are proportional to the velocities, therefore bc' is to $2ba'$ as the velocity in the curve at the point b is to the vertical velocity at the same point.

Now, by the nature of the parabola,

$$GB : CB' :: AG^2 : AC^2;$$

but $AC = 2AI$, or $2CB'$; therefore $AC^2 = 4CB'^2$.

$$\text{Consequently } GB : CB' :: AG^2 : 4CB'^2,$$
$$\text{or } GB : 1 :: AG^2 : 4CB';$$

therefore $AG^2 = 4GB.CB'$, or AG is a mean proportional between CB′, or AI, and 4GB.

Having therefore the initial velocity of a shot discharged from a piece of ordnance, and having found the height due to that velocity by the usual formula, the horizontal range of the projectile may be thus determined. On AI′, as a diameter, describe the semicircle I′HA intersecting in H the line AG, which is a tangent to the curve at the point A, and makes, with the horizontal line AB, an angle GAB equal to the given elevation of the piece: then, joining I and H, since I′AH is the complement of GAB and of AI′H, and since the angles both at H and B are right angles; the triangles I′AH and AGB are similar

hence, $$AI' : AG :: AH : GB;$$

but, as has been just shown, we have

$$AI' : AG :: AG : 4GB.$$

Therefore, by equality of ratios, AG = 4 AH. Consequently, if AG be made equal to 4 AH, and the line GB be drawn perpendicularly to AB, the point B and the extent AB of the range will be determined; or, drawing HK parallel to AB, it is evident, from the similarity of the triangles AKH and ABG, that AB will be equal to 4 HK.

Knowing AB, the position DE of the axis is obtained, and also the height ED; for, from the nature of the parabola, EM ($= \frac{1}{2}$GB) is bisected in D, or ED $= \frac{1}{4}$GB.

When the initial velocity and the horizontal range are given, the corresponding elevation of the piece will be found by simply making AN $= \frac{1}{4}$AB, and drawing a line through N perpendicularly to AB; for such line will intersect the circle IHA in two points, as H and P, except when the angle of elevation is 45°, in which case the line HN would touch the circle at the intersection of AG with the circumference.

Through either of the two points of intersection the line AG being drawn, that line will be the required direction of the gun's axis: it is hence evident that the range will be a maximum when the elevation is equal to 45°, and that any other given range will correspond to two angles of elevation, one of which is as much below, as the other is above 45 degrees.

The time of flight, or that in which the trajectory is described, may be readily found by considering that it is equal to the time in which a body would descend vertically through a space equal to G B; therefore this line being found as above, we have, by the laws of accelerated motions, $t = \sqrt{\frac{2GB}{g}}$; or, since 4 H N or 4 E D = G B, we have $t = 2\sqrt{\frac{2ED}{g}}$, where $g = 32\frac{1}{6}$ feet, that is, the velocity acquired by a body on falling vertically from a state of rest during one second of time.

A construction similar to that above given will serve for determining the ranges on planes oblique to the horizon; for, imagine A B to be such oblique plane, and A I′ to be the height due to the initial velocity: then, if upon A I′ there be described a segment I′ H A of a circle, capable of containing an angle I′ H A equal to the supplement of the angle I′ A B, and intersecting the line of direction A G of the gun's axis, in a point as H, the triangle I′ H A will be similar to the triangle G A B; for, G B being parallel to I′ A, the angle A B G is the supplement of the angle I′ A B, and consequently is equal to the angle I′ H A, and the alternate angles I′ A H and A G B are equal to each other. Hence, as before, A G is a mean proportional between A I′ and 4 G B, A G = 4 A H, and A N $= \frac{1}{4}$ A B. It follows also that when the line of direction A G bisects the angle I′ A B, the range on the oblique plane is a maximum; and that to every other range there correspond two angles of elevation, between which the angle producing the maximum range is an arithmetical mean. Lastly, the time of flight is equal to that in which a body would fall vertically through a height equal to G B or to 4 H N.

With equal charges or equal initial velocities, the ranges are proportional to the sines of twice the angles of elevation. For the maximum range, or that which corresponds to an elevation equal to 45°, is equal to four times the radius O A of the circle on A I′, and the range A B, corresponding to the angle G A B, = 4 K H. But the said radius represents the sine of twice 45°, and K H represents the sine of the angle K O H, which is twice the angle K I′ H or twice G A B and, as the same reasoning will serve for all angles of elevation, it is evident that the ranges vary as the sines of twice the elevation. In the same case the greatest height E D varies as the square of the sine of the angle of elevation. For E D = H N, and the height to which the shot would rise if projected vertically upwards is I′ A: now

I′A : A H : : rad. (= 1) : sin. A I′ H (= sin. G A B),
and A H : H N : : rad. (= 1) : sin. G A B.
Therefore I′ A : H N : : rad.^{2} (= 1) : sin.^{2} G A B.

But I′A is constant when the initial velocity is given; therefore H N varies as sin.^{2} G A B.

When the elevations are the same; since A G is supposed to be described with uniform motion in the same time that the curve A D B is actually described by the shot, the ranges A B, which vary with A G, will vary in a ratio compounded of the time of flight and of the initial velocity; that is, the ranges are proportional to the squares of the initial velocities.

Lastly, the times of flight vary as the sines of the angles

of elevation. For the times of describing any parabolas having the same range A B are equal to the times of describing, with uniform motion, the corresponding lines A G, of direction; therefore, the times vary as the lengths of the line A G vary, or as the lengths of the line A H vary (for A H = ½ A G). Now A H represents the sine of the angle A P H or of the angle G A B; therefore the times vary with the sines of the angles of elevation. And, when the elevations are the same, since the ranges are proportional to the times and the velocities, the times will be directly proportional to the ranges, and inversely proportional to the initial velocities.

The theory of the motions of projectiles would therefore be abundantly simple if it were permitted to neglect the effects produced by the resistance of the air during the flight of the shot; but, in fact, when high charges of powder are employed, the trajectory bears no resemblance to any other kind of curve, and can only be expressed by equations of a transcendental nature.

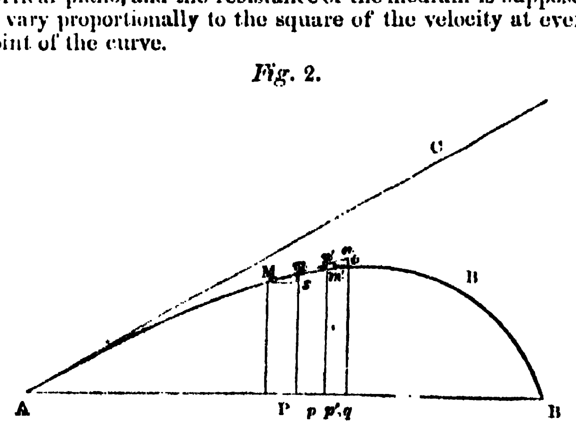
From the time of Galileo to that of Newton, though the subject of the movement of projectiles occupied the attention of nearly every mathematician in Europe, it seems to have been taken for granted that the resistance of the air was too small to deserve much consideration. Even Dr. Halley, while he admitted that its effects might become sensible when the projectile was light, conceived that it would be of no importance when the heavier kinds of shot were employed; and it is easy to conceive that the ideas then entertained of the form of the trajectory were very wide of the truth. Huygens himself, from an unfounded opinion that the resistance was proportional to the velocity simply, asserted that the path of a shot through the air was a logarithmic curve.

It was reserved for Newton to develop the true laws of the resistance experienced by bodies moving in fluid media, and to make a near approach to the form of the curve described by a projectile in the air. In a scholium to prop. 4 (*Principia*, lib. ii.), he shows that such resistance is proportional to the square of the velocity; and elsewhere he proves that, *cæteris paribus*, the resistance to globular bodies varies as the squares of their diameters and as the density of the medium. He also takes notice of the retardation which would be caused by the condensation of the fluid in front of the body when the motion is rapid, and of that produced in consequence of the air not being able to fill up immediately the partial vacuum which exists behind the ball during its flight. And, in a scholium to prop. 10, he explains that the curve described in a uniformly resisting medium is a species of hyperbola having the asymptote of the descending branch in a vertical position.

The evidence afforded by the investigations and experiments of Newton concerning the effects produced by the resistance of the air, induced mathematicians, immediately, to adopt in their researches the principles which he had established. Daniel Bernouilli appears to have been the first who did so; but, from an example in which he compares the ascent of a cannon-ball in the air when projected vertically upwards, with the height to which it would rise in vacuo with the same initial velocity, he has manifestly estimated the resistance much too low.

In the following investigation respecting the trajectory of a shot in air, the line of motion is supposed to be in a vertical plane, and the resistance of the medium is supposed to vary proportionally to the square of the velocity at every point of the curve.

Fig. 2.



Let AB'B *fig.* 2, be the curve, of which let Mm be an indefinitely small arc described in the unit of time (as one second) in consequence of the projectile force; then, if the force of gravity and the resistance of the air were not to act on the shot, the latter might in the next equal portion of time be supposed to describe the line mn in the direction of a tangent to the curve at M. But, during this portion of time, let the diminution of motion caused by the resistance of the air be represented by $n\,n'$ and the deflection produced by gravity be represented by $n'\,m'$; then m' will be the place of the shot at the end of that portion of time. Draw the vertical lines MP, mp, $n'p'$, nq; and the horizontal lines Ms, $n't$. Let AP$=x$, PM$=y$, and the arc AM$=z$; let also R represent the force of the air's resistance and g the force of gravity (both forces being measured by the velocities which they would produce, at the end of one second, in a body moving by their impulses).

Then, by the laws of motion, the velocities varying proportionally to the forces and times of motion, we have Rdt and gdt for the resistance nn' and the force of descent nt during the evanescent portion of time expressed by dt. And by the resolution of motions, $\frac{nt}{n'n}$ R dt will express the diminution of velocity vertically in consequence of the resistance, while $\frac{n't}{n'n}$ R dt will express the horizontal diminution on the same account. But, from the similar triangles Msm, $n'tn$, we have

$n'n : nt :: \mathrm{M}m : ms :: dz : dy$; whence $\frac{nt}{n'n} = \frac{dy}{dz}$.

Also $n'n : n't :: \mathrm{M}m : \mathrm{M}s :: dz : dx$; whence $\frac{n't}{n'n} = \frac{dx}{dz}$.

Therefore the vertical diminution becomes $\frac{\mathrm{R}\,dy\,dt}{dz}$; and the diminution horizontally, $\frac{\mathrm{R}\,dx\,dt}{dz}$. To the former adding gdt for the action of gravity, as above, we have, for the whole vertical diminution of velocity, $\frac{\mathrm{R}\,dy\,dt}{dz} + gdt$.

Now the vertical and horizontal velocities of the shot in vacuo, at M, being represented by ms and Ms; that is, by $\frac{dy}{dt}$ and $\frac{dx}{dt}$ respectively: and, in the ascending branch of the trajectory the forces arising both from gravity and the resistance of the air being retardative, the velocities in the next second of time will be; in the horizontal direction, $\frac{dx}{dt} - d\left(\frac{dx}{dt}\right)$, and in the vertical direction, $\frac{dy}{dt} - d\left(\frac{dy}{dt}\right)$: that is, the diminutions of velocity are, in the former direction, $-d\left(\frac{dx}{dt}\right)$ and, in the latter, $-d\left(\frac{dy}{dt}\right)$. Consequently, $\frac{\mathrm{R}\,dx\,dt}{dz} = -d\left(\frac{dx}{dt}\right) \ldots .$ (I),

and $\frac{\mathrm{R}\,dy\,dt}{dz} + gdt = -d\left(\frac{dy}{dt}\right) \ldots$ (II).

But the resistance experienced by a shot moving through the air is, agreeably to the laws of Hydrodynamics, represented by some part of the weight of a column of the fluid, whose base is a section through the shot perpendicular to the line of its motion, and whose height is that space through which a body would descend in vacuo to acquire the actual velocity of the shot. Therefore let A be the area of such section, v the velocity of the shot, and h the height due to that velocity; and let D be the density of the air; then $\mathrm{h} = \frac{v^2}{2g}$ and $\frac{v^2}{2g}$ A.D = the weight of the column. Putting $2gp$ to represent some number which is to be determined by experiment we shall have pv^2 A.D for the resistance, or for the motion destroyed in one second, and pv^2 A.D dt for the motion destroyed in the time dt. But, by Dynamics, $\frac{\text{momentum}}{\text{mass}} = \text{velocity}$; therefore, if M represent the mass of the shot, $\frac{pv^2\,\mathrm{A.D}\,dt}{\mathrm{M}}$ is the velocity destroyed by the resistance in the time dt; and this is what is expressed above by R dt: consequently we have $\mathrm{R} = \frac{pv^2\,\mathrm{A.D}}{\mathrm{M}}$; or, representing $\frac{p\mathrm{A.D}}{\mathrm{M}}$ by $\frac{1}{\mathrm{H}}$, and for v putting

its value $\frac{dx}{dt}$ we have $R = \frac{1}{H}\frac{dz^2}{dt^2}$. Then the general equations (I) and (II) will become

$$\frac{dx\,dz}{H\,dt} = -d\left(\frac{dx}{dt}\right) \text{ and } \frac{dy\,dz}{H\,dt} + gdt = -d\left(\frac{dy}{dt}\right);$$

but dt being considered as constant, they may be put in the form

$$\frac{dx\,dz}{H} = -d^2x, \text{ and } \frac{dy\,dz}{H} + gdt^2 = -d^2y.$$

From the first of these equations we have $dz = -\frac{H\,d^2x}{dx}$; which, being substituted in the latter, gives $\frac{dy\,d^2x}{dx} + gdt^2 = -d^2y$; or, after reduction, $dt^2 = -d\left(\frac{dy}{dx}\right)\frac{dx}{g}$.

But, multiplying the above equation for $-d^2x$ by $H\,dt^2$, it becomes $dx\,dz\,dt^2 = -H\,dt^2\,d^2x$; which, on substituting in the first member the preceding value of dt^2, becomes

$$dz\,d\left(\frac{dy}{dx}\right)dx^2 = H\,g\,dt^2\,d^2x.$$

Again $dz = \sqrt{(dx^2 + dy^2)} = dx\sqrt{\left(1 + \frac{dy^2}{dx^2}\right)}$; therefore the last equation may be put in the form

$$dx^3\,d\left(\frac{dy}{dx}\right)\sqrt{\left(1 + \frac{dy^2}{dx^2}\right)} = H\,g\,dt^2\,d^2x,$$

$$\text{or } d\left(\frac{dy}{dx}\right)\sqrt{\left(1 + \frac{dy}{dx}\right)} = H\,g\,dt^2\,\frac{d^2x}{dx^3}\ldots\ldots\text{(III)}.$$

This equation, being integrated, would determine the relation between x and y in the trajectory; and, since dt is constant, the integral of the second member is, evidently, $-\frac{H\,gdt^2}{2\,dx^2}$. To obtain that of the first member, let t represent the tangent of half the angle made by a horizontal line and a tangent to the curve at each point; then, by trigonometry, we shall have $\frac{dy}{dx}$ (= the tangent of the whol angle) $= \frac{2\,t}{1-t^2}$, and $d\left(\frac{d}{dx}\right) = \frac{2\,(1+t^2)}{(1-t^2)^2}\,d\,t$; also $1 + \frac{dy^2}{dx^2}) = \frac{1+t^2}{1-t^2}$: consequently, that first member becomes $\frac{2\,(1+t^2)^2\,d\,t}{(1-t^2)^3}$, whose integral is $\frac{t+t^3}{(1-t^2)^2} + \int\frac{d\,t}{1-t^2}$, or $\frac{t+t^3}{(1-t^2)^2} + \frac12\log.\frac{1+t}{1-t}$; therefore the integral of equation (III) is

$$\frac{t+t^3}{(1-t^2)^2} + \frac12\log.\frac{1+t}{1-t} = C - \frac{H\,gdt^2}{2\,dx^2}\ldots\ldots\text{(IV)},$$

where C is an arbitrary constant.

Now, let E represent the angle of elevation at the point A, or the angle C A B; at this point we have $dx = dz\cos.E$, and $dx^2 = dz^2\cos.^2E$; also, at the same point, $dz = V\,dt$, V being the initial velocity of the shot. Therefore $dx^2 = V^2\,dt^2\cos.^2E$, and $\frac{dt^2}{dx^2} = \frac{1}{V^2\cos.^2E}$; but since, by Dynamics, $V^2 = 2gh$, we have evidently,

$$\frac{dt^2}{2dx^2} = \frac{1}{4gh\cos.^2E};$$

then, if this value be substituted in (IV), and tan. ½ E be put for t, that equation will become

$$\frac{\tan.\frac12E+\tan.^3\frac12E}{(1+\tan.^2\frac12E)^2} + \frac12\log.\frac{1+\tan.\frac12E}{1-\tan.\frac12E} = C - \frac{H}{2h\cos.^2E}\ldots\text{(V)},$$

from whence the value of C might be found.

Substituting in the equation (IV) the above value of dt^2, viz. $-d\left(\frac{dy}{dx}\right)\frac{dx}{g}$, and putting for $\frac{dy}{dx}$ its value, $\frac{2t}{1-t^2}$, that equation becomes

$$\frac{t+t^3}{(1-t^2)^2} + \frac12\log.\frac{1+t}{1-t} = C + \frac{H}{2dx}\,d\left(\frac{2t}{1-t^2}\right);$$

whence we obtain

$$\frac{2dx}{H} = -\frac{d\left(\frac{2t}{1-t^2}\right)}{C - \frac{t+t^3}{(1-t^2)^2} - \frac12\log.\frac{1+t}{1-t}}\ldots\ldots\text{VI)}.$$

But, as this expression does not admit of being integrated by any known rules, mathematicians have endeavoured to obtain an approximate value of the integral; and Bezout, whose method has been adopted in the above investigation, employs the following process for that purpose. Developing the expression $\frac12\log.\frac{1+t}{1-t}$ in an infinite series, putting that series in the form of a fraction, whose denominator is $(1-t^2)^2$, and then substituting it in the preceding equation, the latter becomes, after reduction,

$$\frac{2dx}{H} = \frac{-d\left(\frac{2t}{1-t^2}\right)}{C - \frac{2t}{1-t^2}\left[1 + \frac{\frac23t^2 + \frac{4}{15}t^4 + \&c.}{1-t^2}\right]}\ldots\text{(VII)}.$$

Assuming the last factor in the denominator to be constant, and representing it by b, we have

$$\frac{2dx}{H} = \frac{-d\left(\frac{2t}{1-t^2}\right)}{C - \frac{2t}{1-t^2}.b}\ldots\ldots\text{(VIII)}$$

which can easily be integrated, since the second member is equivalent to the differential of a logarithm; thus we have

$$\frac{2x}{H} = \frac1b\log.\left(C - \frac{2bt}{1-t^2}\right) + C'\ldots\ldots\text{(IX)},$$

where C′ is a new arbitrary constant.

The value of b in equation (VII), when simplified, will be found to be equal to ½ sec. E + ½ cotan. E log. tan. (45° + ½ E); and Bezout has computed from this formula a table of its values for every degree of elevation. At 40° we have b = 1·1073 merely; therefore, at elevations not exceeding that number of degrees, we may, without much error, consider b as constant and equal to unity. The value of C, when obtained from equation (V) and simplified, is found to be equal to $\frac{H}{4h\cos.E} + b\tan.E$; and the value of C′ may be obtained by the following process.

At A, the point of projection, we have $x = o$, and $\frac{2t}{1-t^2} = \tan.E$; therefore, at that point, the equation (IX) becomes

$$o = \frac1b\log.(C - b\tan.E) + C';$$

whence

$$C' = -\frac1b\log.(C - b\tan.E), \text{ or } = -\frac1b\log.\frac{H}{4h\cos.^2E}.$$

$$\text{Therefore } \frac{2x}{H} = \frac1b\log.\frac{4h\cos.^2E}{H}\left(C - \frac{2bt}{1-t^2}\right);$$

and putting e for the base of the hyperbolic logarithms (= 2·71828), we have

$$e^{\frac{2bx}{H}} = \frac{4h\cos.^2E}{H}\left(C - \frac{2bt}{1-t^2}\right)\ldots\ldots\text{(X)},$$

$$\text{and } \frac{2t}{1-t^2} = \frac1b\left[C - \frac{H}{4h\cos.^2E}.e^{\frac{2bx}{H}}\right].$$

But $\frac{dy}{dx} = \frac{2t}{1-t^2}$; therefore,

$$dy = \frac{C\,dx}{b} - \frac{H\,dx}{4bh\cos.^2E}\,e^{\frac{2bx}{H}}.$$

This equation being integrated, and the constant determined on the supposition that $y = o$ when $x = o$, we have

$$y = \frac{C\,x}{b} + \frac{H^2}{8b^2h\cos.^2E}\left(1 - e^{\frac{2bx}{H}}\right);$$ or, putting for C

its value,

$$y=\left[\tan.E+\frac{H}{4b^2h\cos.^2E}\right]x+\frac{H^2}{8b^2h\cos.^2E}\left(1-e^{\frac{2bx}{H}}\right).(XI).$$

By substituting in this equation any assumed values of x, we should obtain the corresponding vertical ordinates; and thus the form of the trajectory would be determined, approximatively. But, if the object is merely to obtain the horizontal range, make $y = o$ in the equation; then the latter will, after reduction, become

$$\frac{2b}{H}x\log.e = \log.\left[1+\frac{2b}{H}\left(\frac{2bh}{H}\sin.2E+1\right)x\right].$$

Substituting in this equation different numbers for x, that which renders the two members equal to each other will express the required extent of the range.

In the preceding investigation, g has been taken to represent the accelerative force of gravity, or that by which the shot would descend in vacuo; but, in fact, it should represent the accelerative force by which the shot descends in air. And, in order to obtain the latter force, let r represent the semidiameter of the shot, π the ratio of the circumference of a circle to its diameter ($= 3\cdot14159$), D the density of the air, and D′ that of the shot. Then $\frac{4}{3}\pi r^3 D'$ will express the weight of the shot in vacuo, and $\frac{4}{3}\pi r^3 D$ the weight of an equal volume of air; therefore, $\frac{4}{3}\pi r^3 (D'-D)$ is the weight of the shot in air, and $\frac{4}{3}\pi r^3 g (D'-D)$ is the motive power by which the shot descends; the latter, being divided by the weight of the shot, expressed as above, gives $g\frac{D'-D}{D'}$ for the accelerative power required. But if the shot be of lead or iron, whose weight far exceeds that of an equal volume of air, the term D may be considered as equal to zero, and the accelerative power may be represented by g, the force of gravity on a body in vacuo.

By differentiating the equation (XI), making $dy = o$, and, from the resulting equation, obtaining the value of x; then, on substituting this value in equation (XI), the resulting value of y would be that of the greatest vertical ordinate of the curve, while the said value of x is the corresponding abscissa.

What is called the point blank range is the distance from a point on the ground, vertically under the chamber of the gun or howitzer, to the point at which the shot strikes the ground after the discharge, the axis of the bore being supposed to be in a horizontal position, or parallel to the ground if the latter should be inclined to the horizon. The extent of such range may be determined from the equation (XI), by making $E = o$ and considering y as negative. In this case the said equation becomes, b being equal to unity,

$$-y = \frac{Hx}{4h}+\frac{H^2}{8h}\left(1-e^{\frac{2x}{H}}\right);$$

where y is the height of the gun above the level of the spot on which the shot falls. And the equation, after reduction, becomes

$$\frac{2x}{H}\log.e = \log.\frac{2Hx+H^2+8hy}{H^2}:$$

in which, substituting for x different assumed values, that which renders the two members equal to each other will be the required range.

The *but en blanc* of the French is frequently called the line of metal range, and signifies the distance from the chamber of the gun to the point where the trajectory of the shot crosses (the second time) a line joining the tops of the base, and muzzle rings, and produced. Here the axis of the gun, which is always a tangent to the trajectory at the nearest extremity, makes a small angle with the said line, depending on the dispart, or the difference between the semidiameters of the gun at the base and muzzle.

Now, to find the time of flight: from the equation (IV); by reducing the logarithm to a series and proceeding as before, we shall have

$$Hg\,dt^2 = 2\,dx^2\left(C-\frac{2\,bt}{1-t^2}\right);$$

and having found, from the equation (X), that $C-\frac{2\,bt}{1-t^2}$ is equal to $\frac{H}{4b\cos.^2E}e^{\frac{2bx}{H}}$; we get

$$Hg\,dt^2 = \frac{H\,dx^2}{2h\cos.^2E}e^{\frac{2bx}{H}};\ \text{or}\ dt = \frac{dx\,e^{\frac{bx}{H}}}{\cos.E\sqrt{2gh}};$$

which being integrated gives $t = e^{\frac{bx}{H}}\cdot\frac{H}{b\cos.E\sqrt{2gh}}+C$, where C is an arbitrary constant.

Now, to obtain C; since t (the time of flight) $= o$ when $x = o$, by substituting those values in the equation, the latter becomes

$$o = \frac{H}{b\cos.E\sqrt{2gh}}+C;\ \text{whence}\ C = -\frac{H}{b\cos.E\sqrt{2gh}}$$

and consequently $t = \frac{H}{b\cos.E\sqrt{2gh}}\left(e^{\frac{bx}{H}}-1\right)$.

From which equation, on substituting the value of x (the horizontal range), which is supposed to be given, the time t of the flight of the projectile will be obtained.

It may be observed here that a knowledge of the time during which a shell will describe its trajectory is of great importance, since it enables the gunner so to regulate the length of the fuze, that the shell may explode nearly at the moment that it has reached the object which it is intended to destroy.

Note.—In determining the trajectory, the range, and the time of flight, by the above formulæ, the operations must be performed by the aid of logarithms.

It is of the first importance, in obtaining from the above formulæ a near approximation to the required values, that a correct measure of the velocity with which a shot issues from the mouth of a gun should be obtained; and the determination of such velocity, when the charge of powder is given, is the object of the following investigation, which, using the differential notation, is taken from the third volume of Dr. Hutton's Tracts.

Let r = the semidiameter of the shot, or of the bore.
D′ = the specific gravity of the shot.
π = 3·1416 (the ratio of the circumference of a circle to its diameter).
g = $32\frac{1}{6}$ feet.
m = 33120 oz. (the pressure of the atmosphere on one square foot.)
w = the weight of the shot.
a = the distance from the bottom of the chamber to the hinder part of the ball.
b = the length of the bore.
n = the ratio of the expansive force of fired gunpowder to the pressure of the atmosphere.
v = the velocity of the shot on leaving the gun.
x = any variable distance of the shot, in the barrel, from the bottom of the chamber.
Then $r^2\pi$ = the area of a transverse section through the bore, or of a section through the shot; and
$nmr^2\pi$ = the force of the powder on the hinder part of the ball.

But the expansive force of powder being supposed to be inversely proportional to its density, or to the space which it occupies in the barrel, we have

$\frac{1}{a}:\frac{1}{x}::mnr^2\pi:\frac{mnar^2\pi}{x}$ (= the motive force of the powder at any point, in the barrel, whose distance from the bottom of the chamber $= x$).

Consequently, dividing this term by the weight of the shot, we have $\frac{mnar^2\pi}{wx}$ for the accelerative force of the powder on the shot at that point; from this term subtracting $\frac{mr^2\pi}{w}$, which expresses the retardation arising from the pressure of the atmosphere against the front of the bal' while moving in the barrel, the accelerative force become $\frac{mr^2\pi}{w}\left(\frac{na}{x}-1\right)$; let this be represented by f. Now, by the theory of forces, we have

$vdv\ [= gfdx] = \frac{gmr^2\pi}{w}\left(\frac{nadx}{x}-dx\right)$; and the integra

of this equation is

$$\tfrac{1}{2} v^2 = \frac{gmr^2\pi}{w} (na \text{ hyp. log. } x - x) + C;$$

where C is an arbitrary constant.

To find this constant; since $v = o$ when $x = a$, on substituting these values the equation becomes

$$o = \frac{gmr^2\pi}{w} (na \text{ hyp. log. } a - a) + C;$$

from which C being found and substituted in the preceding equation, the complete integral becomes after reduction, and substituting b for x,

$$v = \sqrt{\left[\frac{2gmr^2\pi}{w}\left(na \text{ hyp. log. } \frac{b}{a} + a - b\right)\right]}:$$

or, substituting for w its value, viz. $\frac{4}{3} r^3\pi$ D′, we obtain for the velocity of the shot on leaving the gun,

$$v = \frac{1783}{\sqrt{rD'}} \sqrt{\left(na \text{ hyp. log. } \frac{b}{a} + a - b\right)}$$

On comparing the results of the formula with those obtained from experiments made with the Ballistic pendulum, Dr. Hutton found that the expansive force of powder varies, with the quantity employed, from 1776 times to 2300 times the pressure of the atmosphere; allowance being made for the loss of force occasioned by the vent and by windage. Those numbers express the values of n in the formula.

From the numerous experiments made with the machine above mentioned between the years 1784 and 1791, Dr. Hutton concludes that the initial velocities of shot are directly proportional to the square roots of the weights of the charges, and inversely proportional to the square roots of the weights of the shot (the guns being similar to each other); and he gives for the initial velocity in feet the formula $V = 1600\sqrt{\frac{2c}{w}}$; where c is the weight of the charge, and w that of the shot. Dr. Gregory's formula, founded on more recent experiments, is, $V = 1600\sqrt{\frac{3c}{w}}$. It must be admitted however that some uncertainty still exists respecting the value of V, partly on account of variations in the quality of the powder, and partly in consequence of the different degrees of windage; and these are the chief causes of the want of agreement between the experimented and calculated ranges of shot. This however is not in general greater than that which has been observed between ranges obtained from different trials when made in like circumstances.

The resistances actually experienced by a shot in passing through the air were, in 1789, made the subjects of experiments, which are described in Hutton's Tracts. From these it appears that the resistances are in rather a higher ratio than the squares of the diameters of the shot; and, as examples of the amount of the resistance, it may be observed, that a ball weighing 3 lbs., when moving at the rate of 500 feet per second, was opposed by a force equal to about 35½ lbs.; and, when moving with the velocity of 1700 feet per second, by a force equivalent to the pressure of above 154 lbs. It was found also that there is a gradual increase in the exponent of the resistance as the velocity increases, probably on account of the partial vacuum behind the ball. When the motions were slowest, the resistance was nearly proportional to the square of the velocity; and when the shot moved at the rate of 1500 feet per second, that exponent seemed to have attained its maximum, the resistance being then nearly as the 2¼ power of the velocity. Beyond that rate of motion the exponent of the resistance gradually decreased.

In the preceding formulæ the height h, or that which is due to the initial velocity, is by the theory of forces equal to $\frac{V^2}{2g}$; where V represents the initial velocity, and g, as before, $= 32\frac{1}{6}$ feet. To obtain the value of H it must be observed that, from hydrostatical principles, we have $\frac{1}{2} r^2 \pi p D$ for the resistance experienced in moving through a fluid by a body which is terminated in front by a hemispherical surface; where r is the semi-diameter of the sphere, D is the specific gravity of the fluid (air in the present case), and p is a coefficient which must be determined by experiment. Then the mass of the shot being equal to $\frac{4}{3} r^3 \pi D'$ (where D′ is the specific gravity of the shot), dividing the former of these terms by the latter we have $\frac{3Dp}{8D'r}$ for the retardative power of the resistance. Hence $\sqrt{\frac{8gD'r}{3Dp}}$ becomes the terminal, or constant velocity, with which the shot would descend in the air when the resistance of the latter becomes equal to the accelerative power of gravity.

Now, in the preceding investigations, $\frac{1}{H}$ was made to represent $\frac{A.Dp}{M}$; therefore, substituting for A its equivalent $r^2\pi$, and for M its equivalent $\frac{4}{3} r^3 \pi D'$, we shall get $H = \frac{4rD'}{3Dp}$; which, being compared with the above expression for the terminal velocity, is evidently the height due to that velocity, or the space through which a body must descend from rest, *in vacuo*, to acquire that velocity.

Dr. Hutton, having formed a table exhibiting the resistances experienced by shot when moving with different velocities, determined from it, by simple proportions, the values of the terminal velocities for solid shot weighing from 1 lb. to 42 lbs. (Tract 37, art. 69.) And in the same Tract (art. 122) he has given a table of terminal velocities for several natures of shells. These last velocities necessarily differ from those of solid shot, because the shells have less weight than solid shot of equal diameters. Assuming therefore that the internal diameter is $\frac{7}{10}$ of the external diameter of a shell, he estimates the ratio of the weights of the solid and hollow shot to be as 1·42 to 1; and, in order to express the terminal velocities of the latter he diminishes those of the former in that ratio. Hence the formula for the terminal velocity of a shell should be

$$\sqrt{\frac{8gr\frac{D'}{1\cdot42}}{3Dp}}, \text{ or } \sqrt{\frac{5\cdot63grD'}{3Dp}};$$

and from the numbers given in the tables it appears that p may be considered as equal to 0·6849. On putting this formula in numbers, r and g must be expressed in terms of the same denomination.

It is easy to conceive that by increasing the charge to a certain amount the velocity will also be increased, and that when the quantity of powder is so great that the ball is driven out of the barrel before the whole has time to act upon it, the velocity must become less. There is evidently therefore a certain quantity of powder which will produce the greatest possible velocity; and this may be determined by making the differential of the expression above found, for the velocity, equal to zero, the length a of the space occupied by the charge being considered as variable. Dr. Hutton makes the charges for producing the maximum velocity to vary with the length of the gun: thus the length of the bore being equal to 10, 20, 30, 40, and 50 calibres, the numbers 0·5, 0·84, 1·09, 1·28, and 1·43 will respectively express the weight of the powder in terms of the weight of the shot. (Tract 37, art. 189.)

The service charges, in terms of the weight of the shot, are—

For brass and iron guns . .	$\frac{1}{3}$
For brass howitzers . . .	$\frac{1}{9}$
For carronades	$\frac{1}{12}$

From experiments which have been carried on at Woolwich, on Sutton Heath, and in France, the following very brief abstract of the circumstances attending the flight of projectiles has been drawn up:—

I. Experiments with solid shot fired at point blank.

Iron Guns.			Brass Guns.			Carronades.		
Height of the Gun above the ground = 8 feet.			Height of the Gun above the ground = 4 ft. 6 in			Height of the Battery above the ground = 8 ft.		
Weight of Shot in lbs.	Charge in lbs.	Range in yds.	Weight of Shot in lbs.	Charge in lbs.	Range in yds.	Weight of Shot in lbs.	Charge in lbs.	Range in yds.
68	9	360	12	4	330	68	5½	[illegible]
32	$10\frac{11}{16}$	420	9	3	310	42	[illegible]	[illegible]
24	8	400	6	2	310	24	2	[illegible]
18	6	400	3	1	350	12	1	[illegible]

II. Ricochet practice in 1821

Solid Shot.

Nature of Ordnance.	Elevation in degrees.	Charge.	Range in yards.	Number of grazes.
24 Pounder Iron Gun	11 6 3¼	8 oz. 1 lb. 2 lb.	400 600 800	13 11 8
18 Pounder Iron Gun	6¼ 7	9 oz. 1 lb.	400 800	27 10
12 Pounder Iron Gun	6¼ 6¼	6 oz. 12 oz.	400 800	19 10
68 Pounder Carronade	6¼	2 lb.	600	5
24 Pounder Brass Howitzer	4¼	1 lb.	600	2

Shells.

Nature of Ordnance.	Elevation in degrees.	Charge.	Range in yards.	Number of grazes.
10 Inch Iron Howitzer wt. of Shell 92 lbs.	5 9¼	4 lbs. 2¼ lbs.	600 600	2. 4
8 Inch Iron Howitzer wt. of Shell 46 lbs.	9¼ 6¼	1 lb. 2¼ lbs.	400 800	12 5
5½ Inch Howitzer wt. of Shell 16 lbs.	9	12 oz.	600	4
24 Pounder Howitzer wt. of Shell 16 lbs.	4¾	9 oz.	400	16
12 Pounder Howitzer wt. of Shell 8 lbs.	8	[illegible] oz.	600	4
68 Pounder Carronade	8¾	1¼ lb.	600	6

From the result of the experiments it appears that at a range of 400 yards, with a weight of powder equal to $\frac{1}{32}$ of the weight of the shot, about two-thirds of the rounds took effect: at 600 yards, with charges from $\frac{1}{32}$ to $\frac{1}{20}$, from one-half to one-third took effect; and, at 800 yards, with charges from $\frac{1}{24}$ to $\frac{1}{12}$, from one-third to two-fifths took effect. It is hence concluded that ricochet batteries should, if possible, be at distances between 400 and 600 yards from the object; at a greater distance much of the ammunition would be uselessly expended. Also that, with both shot and shells, the best elevation for enfilading a work is from 6° to 9° above the crest of the parapet of the work.

III. Practice with a 10-inch mortar, Sutton Heath, 1841. The elevation = 45° and the weight of the shell = 96 lbs.

Charge in lbs.	Time of Flight.	Range in yards.
1 lb.	10″	448
1½ lb.	12	774
2	16	1317
2½	18	1605
3	19	1895

Practice with a French 12-inch mortar, Toulon, 1830. The elevation = 45° and the weight of the shell = 162 lbs.

Charge.	Time of Flight.	Range in yards.
5 lbs. 6 oz.	20″	1631
10 13	28½	2579
16 3	32½	3301
21 10	36½	3872
27	39½	4368

The effects of shot in penetrating any material form a subject of great importance in military engineering, as a knowledge of those effects can alone afford data for constructing walls and roofs capable of resisting the momenta of the vast masses which, during a siege, may descend upon or be projected against them. And in order that such effects may be made the objects of scientific investigation, the resistance which the material opposes must be considered as a uniformly retarding force, like that which gravity would exert against a shot fired vertically upwards: then the depth penetrated will correspond to the space which would be described by a body, when subject to an accelerative force equal to that retardative force, in the time that it would acquire a velocity equal to that of the impact, and the time of the penetration may be considered as equal to that in which such velocity would be acquired. By the theorem of uniformly accelerated motions we have F varies as $\frac{w\,v^2}{s}$ (where F is the accelerative or retardative force, w is the weight of the body, v the velocity with which it is moving, and s the space moved through).

Now, if G represent the force of gravity;

$g = 32\frac{1}{6}$ feet, or the velocity generated in one second by the force of gravity,

$\frac{g}{2}$ = the space or height due to that velocity,

v = the given velocity of impact,

s = the depth of the impression. Then:

$$G : \frac{w\,g^2}{\frac{g}{2}} :: F : \frac{w\,v^2}{s}; \text{ whence } F = \frac{v^2\,G}{s.\,2g},$$ which is the force of resistence exercised by the material.

If G be supposed to be equal to unity, we shall have $F = \frac{v^2}{s.2g}$, and this value of F expresses the ratio of the retardative force to that of gravity; consequently, representing the latter by the weight w of the shot, the force of resistance should be expressed by $\frac{w\,v^2}{s.2g}$.

In Sir Howard Douglas's 'Treatise on Naval Gunnery' there are recorded the following results of experiments on the penetration of an 18-pounder shot into a butt made of beams of oak; viz., with charges of 6 lbs., 3 lbs., 2¼ lbs., and 1 lb., the depths of the penetrations were 42 inches, 30 inches, 28 inches, and 15 inches respectively; the velocities are 1600 feet, 1130 feet, 1024 feet, and 656 feet respectively; and from these data the mean value of F will be found to be 138701. This number expresses the resistance of the oak, in pounds, against a surface equal to the area of a section through the centre of the shot; and, by reduction, it becomes equivalent to 912190 pounds exerted on one square foot.

Similar experiments made at Metz by firing 24-pounder shot against butts of fir (the numbers being reduced to English denominations) gave 475070 pounds for the resistance exerted on a square foot.

At Woolwich, in 1835, two 24-pounder shot were fired with a velocity of 1390 feet per second against a wall of concrete, into which they penetrated to the mean depth of 3 feet 10 inches; whence, by the above formula, we have F = 188047 pounds; and, consequently, the resistance on a square foot is equal to 1013730 pounds. From a like experiment made at Metz it was found that the resistance opposed by a wall of oolitic stone might be expressed by 1394800 pounds (English) on an equal surface.

The French engineers, agreeably to the theoretical determination of M. Prony, suppose the volume, instead of the depth, of the space penetrated to be proportional to the term $w\,v^2$; but when that space is cylindrical, the hypothesis will evidently be identical with that which has been above stated. Dr. Hutton finds that, on firing into wood, the depths of penetration, when high charges are employed, are in a lower ratio than the squares of the velocities, and nearly proportional to the velocities simply: this he supposes to depend on the resistance caused by the elasticity of the fibres which are driven before the ball during the time of penetration.

(Colliado, *Prattica Manuale dell' Artiglieria*, Milan, 1606; Ufano, *Vraye Instruction de l'Artillerie*, Frankfort, 1614; Belidor, *Le Bombardier François*, Paris, 1731; Le Blond, *Traité de l'Artillerie*, Paris, 1743; Du Puget, *Essai sur l'Usage de l'Artillerie*, Amsterdam, 1771; Lombard, *Tables du Tir des Canons*, &c., Auxonne, 1787; D'Antoni, *On Gunpowder and Fire-arms*, translated by Capt. Thomson, London, 1789; Bezout, *Cours de Mathématiques à l'Usage du Corps d'Artillerie*, Paris, 1797; Robins, *New Principles of Gunnery*, London, 1805; Hutton, *Tracts*, London, 1812; Robison, *Mechanical Philosophy*, London, 1822; Sir Howard Douglas, *Treatise on Naval Gunnery*, London, 1829; Straith, *A Memoir on Artillery*, London, 1836.)

GUNPOWDER, a composition with the explosive power of which every one is more or less acquainted. The date of its invention is involved in obscurity. It has been said that it was used in China as early as the year A.D. 85, and that the knowledge of it was conveyed to us from the Arabs on the return of the Crusaders to Europe; that the Arabs made use of it at the siege of Mecca in 690; and that they derived it from the Indians.

Sir George Staunton observes that 'the knowledge of gunpowder in China and India seems coeval with the most distant historic events. Among the Chinese it has at all times been applied to useful purposes, as blasting rocks,

&c., and in the making of fireworks; although it has not been directed through strong metallic tubes, as the Europeans did soon after they had discovered it.'

Roger Bacon has been supposed to allude in an enigmatic way to the composition and explosive force of gunpowder; and about 1336 Berthold Schwartz, a monk, is said to have also discovered the mode of manufacturing it.

Gunpowder consists of a very intimate mixture of nitre, or nitrate of potash, charcoal, and sulphur. According to Mr. Coleman, who has given an account of the process of making gunpowder, as carried on in the royal mills at Waltham Abbey (*Phil. Mag.*, 1801), the proportions are 75 nitre, 15 charcoal, and 10 sulphur.

According to Thénard (*Chimie*, v. 347), gunpowder is made in France of the annexed proportions of its ingredients, for the purposes under mentioned:—

	Sporting.	War.	Mining.
Nitrate of potash .	78	75·0	65
Charcoal . . .	12	12·5	15
Sulphur . . .	10	12·5	20
	100	100·	100

As the combustion of gunpowder is an operation most clearly chemical in its nature, we might expect to find that the proportions of its ingredients are reducible to equivalent weights. In two only however of the four varieties which we have mentioned does this appear to be the case: the French war-powder consists very nearly of one equivalent of nitre, three equivalents of charcoal, and one equivalent of sulphur; while their mining-powder is composed almost exactly of one equivalent of nitre, four equivalents of charcoal, and two equivalents of sulphur.

The ingredients must be of the greatest attainable purity; and the nitre is fused before use, in order to expel the last portion of water, which seems however scarcely necessary for any other purpose than the exact ascertainment of its quantity, inasmuch as the mixture is subsequently wetted. The charcoal, either of alder, willow, or dog-wood, is prepared, not in the usual method, but in iron retorts; and the sulphur is the volcanic kind imported from Sicily, and is refined by melting or subliming.

When the several ingredients are prepared, they are separately ground to a fine powder, and mixed in the proper proportions. The composition is then sent to the gunpowder-mill, which consists of two stones vertically placed, and running on a bed-stone. On this bed-stone the composition is spread, and wetted with as small a quantity of water as will, together with the revolutions and weight of the runners, bring it into a proper body, but not into a paste. After the stone-runners have made the proper number of revolutions over it, and it is in a fit state, it is taken off and sent to the corning-house to be corned or grained; here it is first pressed into a hard and firm body, broken into small lumps, and the powder is then grained by these lumps being put into sieves, in each of which is a flat circular piece of lignum vitæ. The sieves are made of parchment skins, having round holes punched through them; several of these sieves are fixed in a frame, which by machinery has such a motion given to it as to make the lignum vitæ runner in each sieve go round with velocity sufficient to break the lumps of powder, and force them through the sieves, forming grains of several sizes. The grains are separated from the dust by proper sieves and reels; they are then hardened, and the rougher edges taken off by being run a sufficient length of time in a close reel, which has a proper circular motion given to it.

The gunpowder, thus corned, dusted, and reeled (which is called glazing, as it puts a small degree of gloss on it), is sent to the stove and dried; care being taken not to raise the heat so as to dissipate the sulphur. The heat is regulated by a thermometer.

A powder-mill is a slight wooden building with a boarded roof. Only about forty or fifty pounds of composition are worked at a time, as an explosion will sometimes happen from the runners and bed-stone coming in contact, and from other causes. These mills are worked by water or horses. (*Phil. Mag.*, vol. ix.)

The theory of the action of gunpowder is this:—That particle of it on which a spark falls is immediately heated to the temperature of ignition; the nitre is decomposed and its oxygen combines with the charcoal and sulphur, which are also heated; this combination extricates as much heat as is sufficient to inflame successively, though rapidly, the remaining mass. The cause of the expansive force of gunpowder is the production of carbonic acid, oxide of carbon, and azotic gas; and these being liberated at a very high temperature, the effect is greatly increased. According to Gay-Lussac, every 100 volumes of the gas produced consist of 53 parts of carbonic acid, 5 of oxide of carbon, and 42 of azote. The solids remaining after the combustion are principally sulphuret of potassium, sulphate and carbonate of potash, and some charcoal; but it is evident that the proportions and nature both of the gaseous and solid products of the combustion must depend on the composition of the gunpowder.

Gunpowder may be fired by the electric spark, and by percussion. If it be mixed with powdered glass, or any other harder substance, and struck with a heavy hammer on an anvil, it almost always explodes. It readily burns under water, and by using a slowly burning powder, such as squibs are filled with, may be inflamed in a tube of copper, and the gaseous products of the combustion may be collected in a glass jar filled with and inverted in water in the pneumatic trough.

In ascertaining the goodness of gunpowder, which is done by determining its strength, an *éprouvette* is employed to measure its projectile force. This is a small strong barrel, in which a given quantity of the powder is fired, and the comparative expansive force is measured by the action exerted on a spring or weight.

A ready but not a very accurate way of analyzing gunpowder is to wash out the nitre of a given weight by water, weigh the residue, which will show the quantity of nitre dissolved, and boil it in a solution of potash; the residue, after washing and drying, will be the charcoal, and its weight taken from that left after the action of the water will show the quantity of sulphur dissolved by the potash.

GUNPOWDER PLOT. [FAWKES; GARNET.]

GUNTER, EDMUND, was born in the county of Hertford, but descended originally from Gunter's Town, in Brecknockshire. He was educated on the royal foundation at Westminster School, and elected from thence to Christchurch College, in Oxford, in the year 1599, being then eighteen years of age, where he took the degrees in arts. Mathematics were the prevailing studies of his youth, and about the year 1606 he invented the sector, and wrote the description and use of it in Latin; many copies of which were taken in writing, but none of them printed. After this he took orders, became a preacher, in 1614 was admitted to read the *Sentences*, and proceeded to the degree of bachelor in divinity. But his genius still leading him chiefly to mathematical pursuits, when Mr. Williams resigned the professorship of astronomy in Gresham College, he was chosen to succeed him March 6, 1619.....He died on the 10th of December, 1626, about the 45th year of his age.' (Ward, *Lives of the Gresham Professors*.)

The works of Gunter are as follow:—

1. 'Canon Triangulorum,' London, 1620 (8vo.) and 1623 (4to.). A table of logarithmic sines, &c. to seven decimal places, the first of the kind which were published on Brigg's system of logarithms.

2. 'Of the Sector, Cross-staff, and other Instruments' (first published in 1624). The invention of the sector, which now forms a part of every case of drawing instruments, is due to Gunter, and its uses are described by him in three books. [SECTOR.] The cross-staff is not the surveying instrument now known by that name, but an instrument for taking angles, consisting of one straight line moving at right angles to another, with sights at their extremities.

3. 'The Description and Use of his Majesty's Dials in Whitehall Garden,' London, 1624, 4to. These dials (destroyed in 1697) were constructed by Gunter.

The first two of these works went through five editions, the fourth of which, purporting to be examined and enlarged by W. L. (William Leybourn), contains improvements in the sector by Samuel Foster, &c. The fifth, which is a reprint of the fourth, was published in 1673, and (with a new title-page only) in 1680.

Gunter's writings (the 'Canon Triangulorum' excepted) consist almost entirely of a description of graphical methods of constructing problems in trigonometry, navigation, &c. He was the first who laid down a logarithmic scale upon wood, and used it for the purposes of the draughtsman. This scale is still used, and goes by his name. [SCALE.] The common chain used by surveyors also goes by his

name. [CHAIN.] The first observation of the variation of the variation of the compass is due to Gunter. Ward infers this from a letter of Dr. Wallis to Sir Hans Sloane, attributing the observation to a Gresham professor about 1625, which could be no other than Gunter. Other writers mention the same discovery, but without stating their authority. The following is the account of Gunter himself (*On the Cross-staff*, book ii., ch. 5), in which the enunciation of the variation of the variation is an appendage to an example of the method of taking angles by the cross-staff, as follows:—'So that if the magnetical azimuth A Z M shall be 84° 7′, and the sun's azimuth A Z N 72° 52′, then must N Z M, the difference between the two meridians, give the variation to be 11° 15′, as Mr. Borough heretofore found it by his observations at Limehouse in the year 1580. But if the magnetical azimuth A Z M shall be 79° 7′, and the sun's azimuth A Z N 72° 52′, then shall the variation N Z M be only 6° 15′, as I have sometimes found it of late. Hereupon I inquired after the place where Mr. Borough observed, and went to Limehouse with some of my friends, and took with us a quadrant of 3-foot semidiameter, and two needles, the one above 6 inches, and the other 10 inches long, where I made the semidiameter of my horizontal plane A Z 12 inches: and towards night, the 13th of June, 1622, I made observation in several parts of the ground, and found as followeth.' Eight observations are then given, the results of which are from 5° 40′ to 6° 13′, with a mean of 5° 58′.

Gunter is said to have been the first who introduced the words cosine, cotangent, &c. in place of sine of the complement, &c. In the preface of the 'Canon,' he speaks of the 'sine of the complement, which in one word may be called the cosine,' as if he were introducing a new word. There is also the testimony of Briggs (*Arith. Log.*, cap. 13) that Gunter suggested to him the use of the arithmetical complement. Whatever, in short, could be done by a well informed and ready-witted person to make the new theory of logarithms more immediately available in practice to those who were not skilful mathematicians, was done by Gunter.

GUNTOOR. [HINDUSTAN.]

GURRA. [HINDUSTAN.]

GURWAL. [HINDUSTAN.]

GUSTAVUS ERICKSON, commonly called Gustavus Vasa, a descendant of the antient kings of Sweden, was born on May 2, 1490, at Ockestadt, near Stockholm. Sweden, which, by virtue of the treaty of Calmar, made in the year 1397, had become a dependency of the crown of Denmark, had, by a successful insurrection, thrown off the Danish yoke, and was at that time governed by a Swedish stadtholder. Denmark however never relaxed her efforts to regain her dominion, and she at length succeeded with the assistance of the archbishop of Upsal, in the year 1519. Protestantism began about this time to extend itself widely in Sweden, and on this account the pope and the archbishop of Upsal, the primate of the kingdom, afforded to Christian of Denmark all possible help. Christian seized upon the Swedish capital, and caused Erickson, of whom he was most apprehensive, to be confined in Calloe, a Danish fortress. By the assistance of the ecclesiastical party, Christian procured himself to be acknowledged king of Sweden by the assembled people, and was crowned in their presence. Before his coronation he promised to release all prisoners, and to maintain the rights and freedom of the Swedish nation; but within three days after his coronation, and on the 8th November, 1520, he violated his solemn promise, by ordering the chiefs of the most respectable Swedish families, and also the members of the senate, to be arrested, and afterwards beheaded in the market-place. Thus perished in one day eighty-four persons, all belonging to the first families, and among them the father of Gustavus Vasa. When the people who were assembled at the place of execution could no longer restrain their feelings, and showed a disposition to deliver their friends and countrymen from the hands of the executioner, the Danish troops rushed upon the unarmed multitude, and massacred all who fell into their hands, without distinction of age or sex. These executions were continued for several days, and Christian thus hoped to destroy every adherent of the Swedish party. The streets of Stockholm ran with human blood; for three days several hundred dead bodies lay upon the ground, and were at length burnt before the gates of the city. In the meantime young Erickson had escaped from his prison; and after a short stay at Lübeck, where, in vain, he solicited the assistance of that powerful town, had fled into the mountains of Dalecarlia. Here he received intelligence of the bloody scenes enacted at Stockholm, and of the fate of his father. When Christian was apprised of the return of Gustavus, he set a price upon his head, and threatened with death every one who gave him the least assistance. The dread occasioned by these threats closed every door against him; and even an old servant, upon whose fidelity he had counted, not only forsook him, but carried off all his money. Disguised in rags, he wandered about in the mountains of Dalecarlia, till at length he found shelter as a labourer in the mines of Fahlun. After a short time Gustavus left the mines, and entered as a day-labourer into the service of a wealthy farmer at Wika, of the name of Fehrson; but he was soon recognised as the descendant of the kings of Sweden, and, through fear of Christian, was refused an asylum. Wandering in the middle of winter in this severe climate, he was in imminent danger of perishing through cold and want. Some peasants, who found him in a wood nearly frozen, brought him to Peterson, the owner of their village; but here also he was recognised, and while Peterson received him with apparent kindness, he betrayed his abode to the Danish commander of the district. Peterson's wife however, who abhorred the treachery of her husband, saved Gustavus, who fled to the house of a peasant of the name of Nilson, and concealed himself in a cart under a load of straw, with which Nilson was going to Rattwik, farther in the interior of Dalecarlia. On its way the cart was stopped by a party of Danish soldiers, who drove their pikes into the straw in different places. Erickson received a deep wound in the thigh; but fearing capture more than death, he endured in silence the danger and the pain, and succeeded in reaching Rattwik in safety.

Here Gustavus began his preparations for his great undertaking. With unwearying zeal he went from house to house, and from hut to hut, filling the hearts of the rough mountaineers with hatred against the tyranny of Christian. His eloquence was so powerful, that he soon found himself surrounded with a number of resolute combatants. With this force he marched towards Stockholm; his strength increased with each step, for every one participated in the disgust and hatred produced by the cruelties of the bloodthirsty Dane. In May, 1521, Erickson was at the head of 15,000 men; and after a bloody battle, took the town and fortress of Westeras. Victory crowned the arms of the Dalecarlians, to whom the inhabitants of the plains of Sweden quickly united themselves. Christian exhausted himself in powerless threats, while one town after another fell into the hands of Gustavus. At length, after various vicissitudes, and after besieging it three times, Stockholm fell into the hands of Gustavus, and Christian was forced to withdraw to Denmark. The nation which he had freed, in their grateful enthusiasm, offered Gustavus the crown of Sweden, but he declined to accept the sovereignty over his countrymen. Under the title of Stadtholder however he conducted the government of Sweden. But the adherents of the Catholic party and the expelled king of Denmark still continued to disturb the country by their intrigues, and the Swedes became convinced that it was only by the fixed authority of a monarchical form of government, and by putting the power in the hands of Gustavus, that their country could obtain peace and security. Accordingly they again solicited Gustavus to ascend the throne; and in June, 1527, he was solemnly crowned king of Sweden, and thus became the founder of a new dynasty.

Gustavus Vasa reigned in Sweden upwards of thirty-three years. During this long period he displayed such virtues and talents for government, that he acquired fresh and imperishable claims upon the gratitude of his country; and his memory is still cherished by every Swede. (*La Vie de Gustave Erickson, par le* Comte Selly, 1807; *Geschichte von Dalekarlien, aus dem Schwedischen*, 1813.)

GUSTAVUS ADOLPHUS, king of Sweden, was born on December 9, 1594. He was the sixth monarch of the dynasty of Vasa, which, since the liberation of Sweden, in 1520, by its founder, Gustavus Erickson, reigned over the kingdom.

Gustavus Adolphus was the son of Charles, the youngest son of Gustavus Vasa. His father, Charles, had been declared king of Sweden to the exclusion of Sigismund, the heir of the elder line of the house of Vasa. Charles died October 30, 1611, leaving the Swedish sceptre to his son,

then in his seventeenth year. Immediately on his accession the young king had sufficient opportunity for displaying his talents for government. Sigismund, whose father John, as the elder son of Gustavus Vasa, had occupied the throne of Sweden, had been elected king of Poland in his father's lifetime. On accepting the Polish crown, Sigismund abjured the Lutheran faith. This circumstance had offended the States of Sweden, and in consequence in the year 1599 he was declared to have forfeited his right of succession, and his uncle Charles, duke of Sudermania, was called to the throne. As long as Charles lived Sigismund never ventured to renew his claims to the crown of Sweden; but, upon his death, when he saw a youth of seventeen upon the throne, he thought that he should have an easy game against so inexperienced an adversary. Accordingly he invaded Sweden, and laid claim to the crown for his son Ladislaus, then a minor; but this war only served to develop the brilliant qualities of Gustavus. He fought successfully against the Czar of Russia, the ally of Sigismund, and also against Sigismund himself, until, by the mediation of England and Holland, a peace was concluded in 1629, upon the most advantageous terms for Adolphus. A great part of Livonia, and the important town of Riga, were on this occasion annexed to the territory of Sweden. These warlike exploits of the youthful king had drawn upon him the attention of all Europe, and it is not surprising that the eyes of the persecuted Protestants of Germany, who sighed under the tyranny of Ferdinand II. and the barbarous sword of his field-marshal Tilly, should have been directed towards the Swedish monarch for help and protection. The zeal of Gustavus Adolphus for the Protestant religion, and his compassion, excited by the unheard-of cruelties perpetrated upon the persecuted Protestants of Bohemia, were powerful motives for inducing him to aid the German Protestants in their resistance to Austria. But Gustavus felt the truth of the principle, that foreign intervention in the affairs of a country, though certainly welcome in a time of need, is, on that very account, ultimately disagreeable and even hateful. For this reason he printed a declaration in which he endeavoured to prove to all Europe that he was not moved to the invasion of Germany by any improper desire to intermeddle in German affairs, but on account of the enmity already shown towards himself on the part of Austria. In particular he instanced the assistance given by this power to his enemies during the Polish war, and maintained that Austria had violated the territories of Sweden by entering them with hostile troops.

In pursuance of this declaration of war Gustavus Adolphus landed in Pomerania on the 24th June, 1630. When he entered the mouth of the Oder his little squadron bore only sixteen troops of cavalry and a few regiments of foot, which altogether amounted to not more than 8000 men. With this small force however he made himself master of the islands of Usedom and Wollin, and pressed Bogislav, the duke of Pomerania, so warmly, that he was compelled to agree to a treaty by which the town of Stettin was put in possession of the conqueror, and the whole country placed at his disposal.

The army of Gustavus was reinforced by the arrival of six English (or rather Scottish) regiments, under the conduct of the Duke of Hamilton, and he provided himself with money by raising a contribution of 50,000 rix-dollars in Pomerania. The fortress of Wolgast, which fell into his hands, furnished him with arms and ammunition, of which latter he began to be in much want. He next made himself master of the towns of Anclam and Stolpe, and thus opened for himself a road into the province of Mecklenburg. The attack of the Austrians under General Götz on the Pomeranian town of Pasewalk, and the frightful cruelties perpetrated upon the inhabitants so near the Swedish army, exasperated the troops to the highest degree. Gustavus now resolved to prosecute his campaign with increased vigour. He divided his force into four parts. One division, under the Duke of Lauenburg, was ordered to the relief of Magdeburg; General Bauditz was sent to make an attack upon Kolberg; Horn was left with a garrison in Stettin; and Gustavus Adolphus himself encamped at Ribbenitz in the duchy of Mecklenburg. While lying there he received a letter written by the Emperor Ferdinand, containing proposals for peace, in which he made the most advantageous offers to the Swedish king, including the possession of Pomerania. Gustavus however replied that he had not entered Germany for his own aggrandizement, but to protect his fellow-protestants. He therefore rejected these proposals and continued to make himself master of the towns and fortresses of Pomerania and Mecklenburg. By the end of February, 1631, in the course of only eight months, he had already taken eighty fortified places; but the towns of Rostock and Wismar yet remained in the hands of his enemies. The emperor beginning to feel the danger which threatened him from Pomerania, sent against him field-marshal Tilly, at the head of the Imperial army. With varying fortunes Gustavus and Tilly struggled for victory; the Swedes suffered many defeats; yet the success which usually attended the arms of Tilly seemed to abandon him after he had delivered up the inhabitants of the town of Magdeburg to be plundered and murdered by his infuriated soldiers. The army of Gustavus pressed forward into the heart of North Germany. His forces continually increased, and the persecuted Protestants hastened to join his standard. His generals also, who had been acting separately, were victorious. Colberg, Werben, Königsberg, fell into the hands of the Swedes; General Pappenheim, whom Tilly had despatched with four regiments to protect Prussia, suffered a decisive defeat near Magdeburg; and Gustavus, collecting all his forces together, marched into the territories of the Elector of Saxony. On the 1st of August, 1631, the Swedish army encamped near Wittemberg, where Gustavus received Count Arnheim, the ambassador of the elector. Through him a treaty was quickly concluded, by which the Saxon dominions were opened to the king of Sweden, and the whole military power of the electorate placed under his command; while at the same time the elector promised to provide the army with ammunition and provision, and to conclude no peace with Austria without the consent of the king of Sweden. Immediately on concluding this treaty Gustavus prepared to encounter Tilly, who had advanced against him to Eilmarschen. On the 7th September, 1631, they met on the plains of Leipzig. The collected force of the king of Sweden, to which the Saxon troops under Arnheim were joined, amounted to about 40,000 men; Tilly's army was somewhat more numerous. The victory was long doubtful between the two contending armies, led by two of the greatest military commanders of their time; but the enthusiasm of the Swedes, animated by the eloquence as well as the example of their heroic king, at length overpowered the Imperial troops, who fought only for fame or plunder. Tilly's defeat was complete; more than a third of his army remained upon the field of battle, and the remainder owed their safety to his firmness and military talents, which were displayed in most difficult and admirably conducted retreat.

All Germany was now open to the Swedes, and Gustavus hastened forwards in an uninterrupted course of conquest. To his first ally the landgrave of Hesse he made over the country on the Weser, and to the elector of Saxony he promised part of Bohemia. He himself took possession of the beautiful district which lies betwixt the Rhine and the Main. But the progress of the Swedish arms excited the jealousy and apprehension of the whole German population. Even among the Protestants the national feeling was strong enough to make them lament the establishment of a foreign dominion upon the German soil. Gustavus also, whether justly or not does not appear, was accused of having designs on the Imperial crown. His allies became lukewarm, and the inhabitants everywhere viewed the Swedes with dislike. Upon the defeat of Tilly at Leipzig, and the Saxon army making itself master of Bohemia almost without opposition, the Emperor Ferdinand became excessively alarmed, and called in Wallenstein, whom he had some time before dismissed, through the intrigues of the papal party, to oppose Gustavus in the field. Wallenstein, the most extraordinary man of his time, had scarcely received his commander's staff, when he drove the Saxons out of Bohemia, and threatened his adversary Gustavus Adolphus, who in the mean time had obtained a second victory over Tilly on the Lech, in which that general lost his life. Wallenstein took up a strong position in the neighbourhood of Nürnberg, by which he cut off all succours from the king of Sweden, and frustrated his plan of penetrating along the Danube through Bavaria into Austria. In fruitless attacks upon the camp of Wallenstein, and through hunger and disease, in the course of seventy-two days, Gustavus lost 30,000 men. At length Wallenstein moved towards Saxony, and on the 1st of No-

vember, 1632, he offered battle to his opponent at Lutzen. The day of the date of the battle is however differently stated by different authorities.

Gustavus opened the battle of Lutzen to the sound of music, with Luther's hymn, 'Eine feste Burg ist unser Gott.' He himself sang the words, and the army followed in chorus. He led the attack in person, descended at the critical moment from his horse, and killed the foremost of the enemy with a lance. While heading a second attack on horseback against the enemy's cavalry, a ball struck him from behind, and he fell. The horse, without its rider, flying through the Swedish ranks, announced the death of the king; but Duke Bernhard of Weimar crying out to the Swedes that the king was made a prisoner, inflamed them to such a degree, that nothing could resist their impetuosity, and after a frightful carnage the enemy was forced to retreat. The Swedes gained a victory, but with the loss of their king, whose body was found naked and bleeding upon the field. A strong suspicion of the crime of assassination rests upon his cousin the Duke of Saxe-Lauenburg, who at the moment of his fall was near him, and who shortly afterwards entered the Austrian service.

Thus ended the life of Gustavus Adolphus, one of the best men who ever wore a crown. He was simple and moderate in his private life, wise in the administration of civil affairs, and a most able commander. He died esteemed by all, even by his enemies, but lamented by no one, not even by those whom he had saved. The Catholics rejoiced over the fall of their powerful adversary; and the Protestants, who now thought themselves strong enough without his help, were glad to be freed from a master whom they envied and suspected. But the war still raged for sixteen years after his death, and Germany, groaning beneath the cruelties of a profligate soldiery, had frequent occasion to regret the memory, and to wish for the moderation and the discipline observed by the Swedish soldiers of Gustavus.

Gustavus Adolphus married, in 1621, Maria Eleonora, the sister of the duke of Mecklenburg, by whom he had one daughter, Christina, who was his successor. (Schiller; Westenrieder, *Geschichte des dreissig-jährigen Krieges.*)

GUSTAVUS III. king of Sweden, born in 1746, was the eldest son of Adolphus Frederic, duke of Holstein, who, in consequence of his marriage with Ulrica Louisa, the sister of Frederic II., had been called to the Swedish throne in 1743. On the 12th of February, 1771, Gustavus III. succeeded to the crown on the death of his father. The country was at this time divided by two factions, the Hats and Caps, as the aristocratic adherents to the Russian or French policy respectively called themselves, who sacrificed the general good to their own interests. Both parties were detested by the people on account of their pride and oppression, and both parties were dangerous to the crown through their aristocratic privileges. Gustavus took the bold resolution of subverting both these parties with the assistance of the people, and of acquiring more power and importance to the crown, and giving more influence and effect to the democratic principle. With this purpose he endeavoured to gain the good-will of the militia by the institution of his new order of Vasa, and by bestowing preferment upon subaltern officers of talent. Prince Charles, the brother of the king, also travelled through the country, and secured the principal military chiefs to his interest. The execution of the king's plans against the States was commenced by the insurrection of the commandant of Christianstadt, who issued a violent proclamation against the States-General. Gustavus behaved as though he were much irritated at this step, and sent Prince Charles with a powerful force against Christianstadt, ostensibly to subdue the rebel, but in reality to unite with him. On the 19th of August, 1772, the king began to follow out his plans in person. He entered into the Assembly of the States, and fell into a violent dispute with some of the members. In the meantime his agents had secretly assembled all the military officers of the capital, and from the chamber of the States the king hurried to the meeting of officers. These officers, who had been long attached to his cause, received his plan for the abrogation of the States and the alteration of the constitution with loud applause. The different regiments were assembled under arms, and the soldiers, in the midst of continued cheers, swore inviolable obedience to the king. Gustavus next proceeded to arrest the heads of the parties and the most powerful members of the States, and publicly announced his plans for the abolition of the old and the establishment of a new constitution. On the same evening he received the congratulations of the foreign ambassadors, and gave a grand dinner to celebrate his success. The next day the magistracy of the capital took the oaths of fidelity, and the States-General were invited to assemble. Gustavus, having surrounded the assembly-house with soldiers and cannon, entered the assemblage accompanied by his military staff, in order to submit to them the proposed new constitution. This armed force was apparently sufficient to subdue every scruple of the assembly, but it must be acknowledged that this constitution only restricted and circumscribed the privileges of the nobility, and did not infringe the liberties of the citizens. It was accordingly received by the majority with real satisfaction, and confirmed by oaths and signatures. Those who had been arrested were immediately afterwards released, and the revolution was completed.

The nobility were silenced, but they nourished a secret hatred, which at length broke out in the year 1788, when, by their intrigues, they prevailed upon the States to refuse the supplies to the king while engaged in hostilities with Russia and Denmark. The fidelity of the Dalecarlians, however, who proffered their services to the king, and repulsed the enemy from Gothenburg when it was hardly pressed, delivered the country. In order to free himself from the ever-active intrigues of the nobles, the king resolved upon a new *coup d'état*, which he carried into execution on the 3rd April, 1789, when he caused the leaders of the opposition in the Diet to be arrested, and a law to be passed, by which the royal prerogatives were very considerably increased. The first revolutionary measure of Gustavus was excusable on account of its patriotic object; but this second act of violence must be condemned as a purely selfish and arbitrary measure. After varying fortunes in the war, Gustavus concluded a peace on the 14th August, 1790, with his foreign enemies, that he might be at liberty to humble his domestic adversaries; but the nobility, who apprehended the loss of all their privileges, resolved upon his death. Accordingly they formed a conspiracy under the direction of Counts Horn and Ribbing, and Colonel Lilienhorn; and a nobleman, named Ankerstroem, whom he had personally offended, undertook to murder him. Ankerstroem chose a masked ball, which was given on the 16th March, 1792, at Stockholm, as the fittest opportunity for carrying his design into effect. The king was warned by some anonymous friend; but he went to the ball, and was pointed out to the assassin by Count Horn, who tapped him on the shoulder, and said 'Good evening, pretty mask.' Upon this, Ankerstroem shot the king through the body from behind, and mingled with the crowd of masks. The king suffered with much firmness, and died on March 29. His murderer was discovered and executed, and many of the conspirators were banished out of the country.

Gustavus III. was a prince of very distinguished talents; his original intentions were noble, but prosperity corrupted him, and it became his object to acquire despotic power. It is remarkable that this king, who, as a statesman, was so cool and self-possessed, was distinguished as a poet by his warmth of feeling and his fancy. He was the author of several highly esteemed dramatic works; and in the Swedish Academy, of which he was a member, he displayed a high degree of eloquence in various discourses upon historical and philosophical subjects. Gustavus III. was a memorable example of a king uniting himself with the democratic party in order to oppose the encroachments of a powerful aristocracy. Had he been satisfied with his first success, and firmly secured to himself the sympathy of his people, the ambitious nobility would hardly have ventured on the perpetration of such a crime. (Posselt, *Gustav III. von Schweden.*)

GUSTAVUS IV., king of Sweden, was born on the 1st of November, 1778, and, after the murder of his father Gustavus III., ascended the throne on the 29th of March, 1792. This king, who by his conduct so completely alienated the national feelings, that, forgetting his great ancestors, they gave the throne of Gustavus Adolphus to a Frenchman, displayed, while a prince, a capricious humour and an obstinacy that bordered upon madness. He entered into a negotiation for a marriage with the grand-daughter of the Empress Catherine of Russia, and suffered it to proceed so far that the whole court was assembled in order to be present at the solemn ratification of the marriage-treaty. But instead of confirming the treaty, he departed secretly,

and shortly afterwards married a German princess of the house of Baden. Of all the European monarchs he was the most zealous partisan of legitimacy, and he proposed, as the great object of his life, the restoration of the dethroned family of the Bourbons to the crown of France. In 1803 he made a journey through Germany in order to unite all the sovereign princes of the Empire in arms against Napoleon; and to show his detestation of the usurper he sent back to the king of Prussia the order of the Black Eagle, because the same distinction had been given to Napoleon. When Bonaparte concluded peace with Germany in 1806, Gustavus IV., through his ambassador, declared that he would no longer take any part in the proceedings of the Diet while it remained under the influence of a usurper. Nothing more was required to make him break off all diplomatic relations with the most powerful courts of Europe than an approach on their part to friendly relations with Napoleon. He thus involved his country in indescribable difficulties; irritated all his neighbours, and showed by his conduct that he would not scruple to sacrifice his people's welfare to his unreasoning obstinacy. His wars and negotiations exhausted the poverty of Sweden, and the inhabitants sighed beneath an intolerable burthen of taxes. Even England, his only ally, whom he certainly could not reproach with any friendly feelings towards Napoleon, he contrived to offend by his conduct. Upon the English government sending him a message with some well-grounded complaints, he broke off with this power also, and ordered all the English ships in Swedish harbours to be laid under embargo.

The Swedes soon became tired of seeing themselves sacrificed to the extravagant follies of this Don Quixote of legitimacy, and the most influential patriots began seriously to consider how they could rescue their country from total destruction. Gustavus appears to have discovered through his spies that a storm was gathering about him, and, either in order to avert it, or to make himself safe in any event, he endeavoured to possess himself of the funds deposited in the bank of Sweden. At first he made an attempt to get the money into his hands by means of a proposed loan of eighty-two millions of Swedish rix-dollars (about twelve millions sterling), but as the bank commissioners refused to comply with this demand, he resolved to carry his plan into effect by force.

On the 12th of March, 1809, he repaired to the bank, accompanied by a detachment of military, with the intention of taking possession of the money deposited there. The commissioners of the bank had applied for protection to the Diet, and the Diet had directed Generals Klingspor and Adlerkreutz to divert the king from his intention by persuasion, or to prevent him by force. The generals met the king in the court of the bank buildings, and endeavoured to make him aware of the impropriety of his conduct; but Gustavus treated them as rebels, and ordered the soldiers to remove them from his presence by force. Adlerkreutz then advanced, seized the king by the breast, and cried with a loud voice—'In the name of the nation, I arrest thee, Gustavus Vasa, as a traitor.' Of the soldiers who were present, about forty endeavoured to defend the king, but the majority followed the call of the general to carry into effect the orders of the Diet. Gustavus defended himself with desperation, and it was only by force that they could disarm him. He tore himself loose from the hands of the soldiers, and had very nearly escaped, but was again secured, and confined in an apartment, where for several hours he raged like a madman. Immediately upon the arrest of Gustavus, Duke Charles of Sudermania issued a proclamation, in which he announced that he had been called to the head of a regency, and exhorted the people to quietness till the decision of the States-General should be promulgated. On the 24th of March Gustavus was brought to the castle of Gripsholm, where he gave in his abdication. On the 29th there appeared the decision of the Diet, by which Gustavus IV. and all his direct descendants were declared to have forfeited their rights to the Swedish crown, and the Duke of Sudermania ascended the now vacant throne of Sweden under the name of Charles XIII.

Gustavus left the Swedish territories very shortly after his deposition. During his exile he travelled through most of the countries of Europe, but lived chiefly in the little town of St. Gall, the capital of the Swiss canton of the same name. He assumed the name of Colonel Gustavson, and renounced all external observances that might remind him of his former rank. He refused the appanage which Sweden offered him; he urged forward a suit of divorce from his wife, which he succeeded in obtaining on the 17th of February, 1812; and he declined having any communication with his family, and obstinately rejected all assistance from them. He subsisted on the produce of his labours as an author, together with a little pension which he drew as a colonel.

Among his printed works, which appeared during his residence in Switzerland, one very systematically develops the mystical-religious and ultra-royal political tendencies of his mind. The moderation and discretion, as well as the stedfast tranquillity with which he endured his fall did him honour, and almost excuse the follies through which he trifled away the possession of a throne. He was a martyr to his principles, which were founded upon his extravagant notions of the divine right of kings over their subjects.

He died at St. Gall, toward the end of the year 1837, lamented by all who had known him in the latter years of his life. His son, the heir of the line of Vasa, now lives at Vienna, a colonel of an Austrian regiment.

GUSTROW. [Mecklenburg-Schwerin.]

GUTENBERG, believed to be the first inventor of the art of printing with moveable types, whose real name was John Gensfleisch, was born in 1397 at Sulgeloch, a village near Mentz. His youth was passed in the latter city, where he acquired the name of Henne (*i.e.* John) von Gutenberg, from that of the family with whom he dwelt. During his residence in Mentz he became implicated in an insurrection of the citizens against the nobility, and was compelled to fly to Strasburg to avoid the vengeance of his victorious adversaries. At Strasburg necessity compelled him to employ himself in mechanical occupations, and by accident he made the discovery so pregnant with future consequences. After the animosity of his persecutors had subsided, Gutenberg returned to Mentz, and endeavoured, in conjunction with Fust, a rich citizen of that town, and his son-in-law Schoeffer, to turn his invention to a profitable account. But Gutenberg experienced the hard fate that all great inventors have to endure from the misconceptions and ingratitude of mankind. The members of the Guild of Writers, at that time an influential body, together with the priests, persecuted him; his partners Fust and Schoeffer joined with his enemies against him; through litigation he was deprived of all his property; and once more he was forced to turn his back upon the ungrateful town. In the meantime Fust and Schoeffer pursued their business as printers, and thus reaped all the profit, while the inventor was wandering in exile. After an interval of many years Gutenberg returned to Mentz, where he died in 1468.

Posterity has endeavoured in some degree to make amends for the ingratitude of Gutenberg's contemporaries. Last year (1837) a splendid monument by Thorwaldsen was erected to his memory in Mentz. The Gutenberg Society, to which all the writers of the Rhenish provinces belong, hold a yearly meeting also in Mentz to honour his memory and to celebrate his discovery. [Fust.] The 'Statuta Provincialia antiqua et nova Moguntina,' 4to., are thought to have been printed by Gutenberg, with two or three editions, of which fragments only remain, of Donatus. Some have thought the Mazarine bible to have been a production of his press. (Wagenseil, *Biographieen.*)

GUTHRIE, WILLIAM, was born at Brechin, in the county of Angus, Scotland, according to one account, in 1701, according to another in 1708. He was educated at the University of Aberdeen; but little or nothing is known of his early years, except that it is said he was induced to leave his native country by a disappointment in love, on which he came to London, and commenced writing for the booksellers. He was one of the most popular compilers of his day, and must have been one of the most industrious writers ever known, if he was the author of all the voluminous works to which his name is prefixed. Among them are a History of England, 3 vols. fol.; a History of Scotland, 10 vols. 8vo.; a General History of the World, 13 vols. 8vo.; a History of the Peerage, 1 vol. 4to.; a translation of the Institutes of Quintilian, 2 vols. 4to.; translations of nearly all the writings of Cicero; 'The Friends,' a novel, in 2 vols. 8vo.; 'Remarks on English Tragedy,' &c. But in the preparation of most of these works he is believed to have had little share, beyond lending them his name,

which it would appear was in repute with the booksellers. The well-known 'Geographical Grammar' which bears his name is believed to have been compiled by a bookseller in the Strand, of the name of Knox. Guthrie found the trade of authorship not an unprosperous one; and to what he gained with his pen was, in course of time, added a pension from government, which it may be supposed he earned by some writings acceptable to the court, or by other unknown political services. He was also placed in the commission of the peace for Middlesex, although it is said he never acted as a magistrate. He died in 1770. Guthrie's 'General History of England, from the Invasion of the Romans under Julius Cæsar to the late Revolution in 1688,' which is the historical work of which his claim to the authorship is the most undoubted, is written in a style by no means without warmth and animation, though it has not much claim to the praise either of penetrating judgment or extensive research. The author is rather fond of new and peculiar views—one instance of which that may be mentioned is the light in which he endeavours to place the conduct and character of Richard III., many of the common stories in regard to whom he disputes in a manner that led him afterwards to claim the honour of having anticipated nearly all that was most remarkable in Horace Walpole's 'Historic Doubts.' But in truth both he and Walpole had been long before preceded in the same line of argument by Sir George Buck. The 'History of England' bears throughout, and especially in the latter part, the marks of having been written in haste, and under the pressure of limits too narrow for the author's not very economical style. It is however a large work; the first volume, which was published in 1744, and comes down to the accession of Edward II., containing 962 pages; the second, published in 1747, and coming down to the accession of Edward VI., 1130 pages; and the third, published in 1751, 1396 pages. After all, the narrative stops at the Restoration, the author apologising for putting a period to his work at that point, 'contrary indeed,' he says, 'to my obligations to the public, but I hope not contrary to the sense of my readers, upon whom this volume has already grown so enormously.'

GUTTA SERE'NA is that kind of blindness which arises from derangement or disease of the nerves of the eye, whether before or after their separation from the brain. The name originated in a notion, long prevalent in the schools, that all diseases are attributable to some deleterious fluid or humour circulating in the blood or diffused in the substance of the part affected. The epithet *serene* was intended to intimate the comparative freedom from pain, and the absence of any unpleasant change in the appearance of the eye, which distinguish this class of ophthalmic complaints from others equally destructive of sight. Hence Milton, whose blindness was of this kind, thus addresses Light (*Paradise Lost*, iii. 22):—

'But thou
Revisit'st not these eyes that roll in vain
To find thy piercing ray, and find no dawn;
So thick a *drop serene* hath quenched their orbs,
Or dim suffusion veiled:'

and in the lines to Cyriack Skinner, he notices both the external peculiarity and the cause (by far the most frequent one) of his blindness, as well as the occasional suddenness of its attack:—

'Cyriack, *this three years' day* these eyes, *though clear*
To outward view of blemish or of spot,
Bereft of light, their seeing have forgot,
* * * * *
* * * What supports me, dost thou ask?
The conscience, friend, *to have lost them overplied*
In liberty's defence, my noble task.'

But the rejection of the humoral pathology has been extended to the nomenclature derived from it; and this fanciful, though still popular term, which seems to have been devised expressly for the poets, has given place in modern systems of nosology to that of *amaurosis* (ἀμαυρος, *blind*).

The most frequent seat of the complaint is the retina; the next is probably the brain itself, or that part of the optic nerve which, lying within the cranium, is in contact or communication with the brain, and partakes of its diseases. But recent observations and experiments have proved that the affection of the optic nerve may be secondary; and that the primary seat of the disease may be in certain other nerves connected with the eye, though not immediately subservient to vision. It may likewise be symptomatic of irritation in some distant organ, probably through the intervention of the same class of nerves. The temporary failure of sight during a bilious attack is of this nature: we may also here mention once for all that the affection is sometimes merely hysterical, in which case though the blindness may be total it is rarely permanent; and the same remark may be made of a kind of amaurosis which occasionally results from the irritation of worms in the intestinal canal.

The effects of remedies and some other considerations appear to lead to the conclusion that amaurosis is generally of an inflammatory nature, or dependent at least upon a congested state of the blood-vessels. It is however unquestionably sometimes the result of an opposite state, for it may be brought on by excessive or repeated losses of blood, by long-continued nursing, and by other immoderate discharges and secretions, and is sometimes the effect of mere debility.

It may be caused by simple pressure on the optic nerve, as by the growth of a tumour, or by apoplectic effusions within the head: in this case it is analogous to the paralysis of a limb. A slight stroke received unexpectedly upon the naked eye-ball may produce it, although a violent blow when the lids are firmly closed has no such consequence. In this case it is called concussion of the retina, and is analogous to concussion of the brain. It may also be the instantaneous effect of a flash of lightning. But the most frequent causes of amaurosis are exposure of the eye to too bright a light, as in watching an eclipse of the sun; or over-exertion of it in laborious study, especially at night, or in occupations such as that of the watchmaker. The Esquimaux are very subject to this complaint from the bright reflexion of their snow-fields; and have learned by experience to guard against the danger by using snow-spectacles, which are pieces of wood pierced with small circular holes, bound before the eyes, so as to shut out a part of the field of view.

We cannot enter at length into the symptoms of amaurosis, which vary of course with the seat, the cause, and the degree of injury. The chief symptoms are a more or less rapid failure of sight, by an increasing dilution of light with darkness (if the expression may be allowed), rather than by the appearance of a cloud. Moving spots, called *muscæ volitantes*, are generally seen to flit before the eyes, especially when they are closed. There is generally some degree of pain in the organ itself, and in the forehead; when the complaint arises from exhaustion, it is felt chiefly towards the back of the head. Exertion of the sight is always fatiguing and painful. The pupil is either preternaturally large or small, and obeys the stimulus of light either not at all or very sluggishly. The eyeball is sometimes too soft; in other cases unusually firm; or it may be of the natural degree of hardness. A degree of fever is occasionally present. If one eye becomes affected, the other generally follows, especially if the cause be common to both. The complaint is most usual after the middle period of life; it is frequently found to affect members of the same family, and comes on about the same age. Dissipation of all kinds, and especially habitual inebriety, predispose to it.

Confirmed amaurosis is seldom cured; but in its early stages much may be effected by careful and skilful treatment; and the means may generally be adapted with great precision to the nature of the case, by attentive consideration of its symptoms and history.

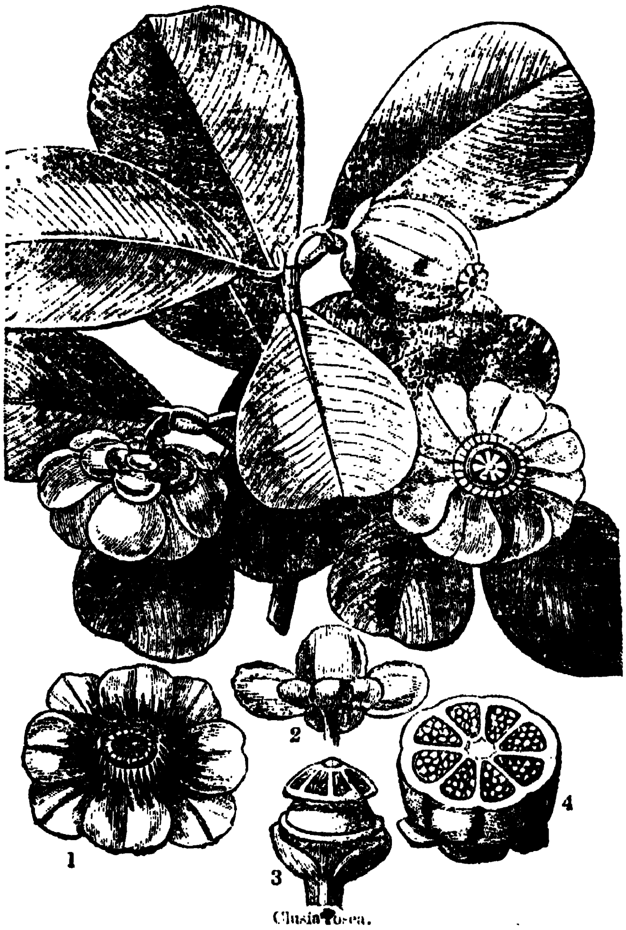
Depletion, aperient medicines, abstinence, and a darkened chamber, must of course form a part of the treatment when the case is inflammatory: but mercury, pushed if necessary to the extent of salivation, is the remedy most to be relied on; indeed, without it, the oculist would have little chance of success in any case.

When the symptoms arise from exhaustion, an opposite plan of treatment is obviously proper; but even then the moderate action of mercury is sometimes requisite. Blisters behind the ears and between the shoulders are frequently of great service in both descriptions of cases. In *sympathetic* amaurosis the attention must of course be directed in the first place to the organ which is the original seat of irritation.

This complaint not unfrequently forms a complication of cataract and of closed pupil; probably from extension of the inflammation from the parts of the eye affected in those disorders to the choroid coat or to the retina. Operations for the cure of either of those causes of blindness would be attended with no advantage in such cases, and should not be undertaken.

GUTTI'FERÆ, or **CLUSIA'CEÆ**, form a small natural order of Exogenous plants, inhabiting the hotter parts of

tropical countries in both the Old and New World. They are readily known by their coriaceous opposite leaves, with very fine veins running parallel with each other in a gentle curve from the midrib to the margin; by the absence of stipules; their calyx composed of several sepals regularly overlapping each other, and bearing a definite proportion to the petals; their numerous stamens; and their superior ovary, which is in most cases many-celled and many-seeded, with a peltate radiant stigma. Their fruit is succulent, juicy, and in many cases resembling a large apple or orange. The Mangosteen (Garcinia Mangostana) is probably the most delicious of any known; but it has never been seen in a fresh state in Europe, for the tree will hardly exist out of its native humid heated atmosphere in the Indian Archipelago. In general the fruit of these plants is acrid and astringent, and quite unfit for food. The most remarkable product of the order is Gamboge, which is secreted by the branches of Hebradendron Cambogioides, and perhaps some other species. Others yield an astringent gum-resin, called Tacamahaca.



Clusia rosea.

1, an expanded flower; 2, a calyx seen from below; 3, the ovary, with a part of the calyx cut away; 4, a transverse section of a fruit.

GUTTULI'NA. [FORAMINIFERA, vol. x., p. 348.]

GUTTURALS. [ALPHABET.]

GUYA'NA, or GUAYA'NA, often called Guiana, is the name applied to the north-eastern portion of South America extending from the banks of the river Orinoco southward to those of the Amazon river. It is bounded on the west by the Guaïnia or Rio Negro, the natural canal of Cassiquiare, and the middle course of the Orinoco. Its surface covers an area of more than 650,000 square miles, exceeding three times that of France; but more than five-sixths of it are included within the boundaries of the empire of Brazil and the republic of Venezuela, under which articles these portions are noticed. We limit the present description to those parts which comprehend the English, Dutch, and French settlements, and which may probably cover a surface of about 100,000 square miles, or double that of England without Wales.

The boundary between Brazil and the French colony is formed, according to the common authorities, by the river Oyapock, but the boundary which separates the English settlements from Venezuela has never been determined, and some modern writers extend the British territory to the very mouth of the river Orinoco, though others fix it at Point Nassau (near 59° W. long.), more than a degree farther east. The southern and western boundary are still more dubious, the district through which they run not having been visited; but it is understood that all the countries drained by the rivers which fall immediately into the Atlantic Ocean belong to the European nations, while those which are drained by the streams which fall into the Amazon and Orinoco rivers are appurtenances of Brazil and Venezuela respectively. The upper valley of the Cuyuni however forms an exception, being annexed to Venezuela. The Oyapock falls into the sea near 55° W. long. and 4° N. lat., and the Orinoco 60° W. long. and 8° N. lat., so that the sea-coast extends over more than 400 miles. The most southern branches of the Essequibo river probably approach 1° N. lat.

The shores of this country are skirted by a mud bank, extending about seven or eight miles out to sea. The water on this bank decreases gradually towards the beach, so that vessels drawing more than twelve feet water stick fast in the mud about three miles from the land. The land is very low, and presents so great a uniformity for several hundred miles together that it is impossible to know what part of the coast a vessel has reached. Ships therefore which are strangers to the coast run along the land till they see a house, and then send a boat ashore through the mud to ask what part of the country it is. The sea exhibits the appearance of a dirty puddle of water, and nothing of the land is visible but the tops of the trees just above the sea; it is a perfect flat without any feature of variety. The mouths of the rivers are discovered by the difference of the colour of the fresh water, which extends a great many miles out to sea. Mud or sand has accumulated in front of them to such an extent that large vessels cannot enter them.

Surface and Soil.—The low and flat country extends from 40 to 70 miles inland, and is mostly on a level with the sea at high-water. When these lands are drained, banked, and cultivated, they become consolidated and sink fully a foot below the level just mentioned, and consequently it requires unremitting attention to the embankments and sluices to keep out the sea. The greatest part of this low plain is covered with an alluvium of strong blue clay, highly impregnated with marine and vegetable salt, and vegetable matter in the finest state of comminution. It is of great fertility, and as the first crop fully pays the original cost of embanking and cultivating the soil, the cultivated land in Guayana is rapidly increasing. At a distance from the rivers however there are in some parts tracts of land which in their natural state are without trees or shrubs, and overgrown with fern; these tracts are entirely unfit for cultivation, but they are not numerous nor extensive. In other places there are savannahs of considerable extent, which afford good pasture, but by far the greatest portion of the surface is covered with trees and fit for the growth of every kind of grain and tropical products.

The high land which lies at the back of this plain was till recently almost entirely unknown. In the year 1835 the London Geographical Society send out Mr. Schomburgk, a naturalist and experienced traveller, to examine this region, and to his industry we are indebted for our acquaintance with the principal natural features of this extensive region, as far as it is included in the British dominions. Those portions of the high land which are annexed to the Dutch and French settlements have not been visited and are almost entirely unknown.

The high land does not rise immediately from the plain to a great elevation, the hills on its southern edge attaining only a height of from 50 to 200 feet above the plain. Behind these hills the high land stretches out in level or undulating plains, rising here and there into eminences; but farther south ranges of hills appear running north-west and south-east parallel to the coast, or rather to the northern edge of the upper region, and south of them the surface is again depressed and extends in plains. The most elevated of these ranges is that which, near 5° N. lat., runs along the southern banks of the river Mazaroony, and on the east approaches the river Essequibo, where it is called the Twasinkie Mountains; they rise 1100 feet above the river, which here breaks through the range, forming several rapids. On the other side of the river the range continues east-south-east to the banks of the river Berbice, where Parish Peak rises to 910 feet above the sea, near 4° 50′ N. lat. From this point

it runs south-east to the great cataracts of the river Courantin, situated 4° 21′ N. lat. This chain seems to form the boundary of the first great terrace. South of it the country again forms a level or undulating plain, but somewhat south of 4° N. lat. is the Sierra Pacaraima, which farther west constitutes the boundary between Brazil and Venezuela, separating the rivers which fall into the Rio Branco from those joining the Caroni. In Guayana it separates the basins of the rivers Rupunoony and Siparoony (both affluents of the Essequibo), and terminates near the mouth of the Rupunoony with the Makarapan Mountains (3° 55′ N. lat.), which rise boldly to the height of 4000 feet. The general elevation of the range does not exceed 1500 feet. This chain does not appear to continue east of the Essequibo. Farther south there is a third range, which cuts the parallel of 3° N. lat. obliquely, running west-south-west and east-north-east between 58° and 59° W. long.: it is called Sierra Taripona, and rises from 500 to 1000 feet above the plains which surround it; the summits are of a conical shape. The fourth longitudinal ridge in the upper region occurs farther south (2° N. lat.), and is called the Carawaymee Mountains. On its northern declivity the Rupunoony rises, and it seems to form the western extremity of that chain of mountains which on the Portuguese maps is called Sierra Acaray, and in which the Essequibo and Courantin probably have their sources. Farther east this chain has not yet been visited by travellers coming from the north. All these ranges, as far as is known, occupy an inconsiderable width, and the plains between them are of great extent.

Through the plain extending between the Sierra Pacaraima and the Sierra Taripona there is a natural communication between the rivers which traverse British Guayana and the Rio Branco, which falls into the Amazon river. The Rupunoony flows near some of the upper branches of the Rio Branco, and is separated from them by a low and level tract (near 59° W. long.). This tract contains the lake Amucu, which in the dry season is of small extent, but after the rains have fallen inundates the adjacent low country, and its waters run partly eastward into the Rupunoony and partly westward into the Rio Branco. In the dry season its waters are discharged only into the Rio Branco by the small river Pirarara.

The plains south of the Pacaraima range are in general very level and form extensive savannahs covered with grasses and plants; the winding course of the rivers alone is marked by a fringe of trees, and some swampy tracts of small extent are overgrown with the *Mauritia vinifera*. In some places the savannahs are without any vegetation, but a broad belt of good soil extends along the foot of the mountains. The country north of the Pacaraima range has a different character. Its surface is less level and more diversified by eminences and depressions. The belt of wooded and rich land along the water-courses is covered with high forest trees, which are separated from the savannah farther inland by a tract of bushes rising about twelve feet high, but displaying a great luxuriance of vegetation. The savannahs themselves are of comparatively small extent, and contain many wooded tracts and elevations. The proportion of rich and cultivable land in this region is very great.

Rivers.—The largest river is the Essequibo, which traverses nearly the middle of British Guayana. It has been ascended to 3° 14′ N. lat., a distance of about 230 miles from its mouth in a straight line. At that point the river is still some hundred yards wide, and forms a great cataract, called King William's Cataract. From this point it runs in a north-by-west direction, and receives, near 4° N. lat., the waters of the Rupunoony, a large river whose course has been investigated nearly to its source in the Carawaymee mountains (2° N. lat.). The Rupunoony runs first north-west, and, after passing the western extremity of the Sierra Taripona, north-east, turning gradually to the north, and, where it approaches the Sierra Paracaima, to the east, in which direction it continues along the foot of the range till it meets the Essequibo. Its course is 220 miles. After this junction the Essequibo continues in a north-western direction nearly up to 5° N. lat., receiving in this course a great tributary, the Siparoony, whose course has not yet been examined; and forming a great number of rapids and cataracts, which can only be passed by small vessels, and with danger. North of 5° its tortuous course is in general to the north; here too there are several dangerous rapids, and a great number of rocky islands in the river, among which the island of Gluck is 7 miles long, but narrow. Fifty miles from its mouth occur the last rapids, which, though not high, are numerous, and render the ascent of the river impracticable for larger barges: up to this point the tides ascend. Five miles lower down the river enters the low plain, and is here from 1 to 1½ mile wide, growing continually wider until at its mouth it forms an æstuary 14 miles wide. Within the plain it receives from the west the waters of the united rivers Mazaroony and Cuyuni, which at the point of junction are more than a mile wide. The course of the Mazaroony is parallel to the lower course of the Essequibo, and has been examined to a considerable distance; its bed is full of rocks, and the rapids are numerous. The Cuyuni runs east and west, having its source in a ridge of rocks situated a short distance from the banks of the Orinoco, and no great distance from the mouths of that river. It is said that it may be navigated for about 300 miles, but the greater part of its course lies within the republic of Venezuela. The Mazaroony and Cuyuni unite 8 miles before they reach the Essequibo. In the wide æstuary of the Essequibo there are numerous islands, some of which are extensive. Hog Island is large and well cultivated. Across the entrance of the river are three islands. Wakenaam the largest, which lies in the middle, is from 7 to 8 miles long; east of it is Leguan, 6 miles long, and half as many broad; it is in a high state of cultivation; the most western of the three islands, Tiger Island, is the smallest, and not cultivated. The entrance of the Essequibo is very dangerous and difficult, even for small craft, on account of the banks of mud and sand. The best and safest of the four channels formed by the three islands is between the east shore and the island of Leguan. The course of the Essequibo from the point where it unites with the Rupunoony to its mouth, taking its windings into account, is about 240 miles, and when the Rupunoony is added, 460 miles, which exceeds the course of any river of France.

East of the Essequibo and parallel to it runs the Demerara, whose sources have not been visited, but they are probably a little south of 5° N. lat. At 5° 25′ N. lat. it forms a great cataract, and below it becomes navigable for small craft. As far as Lucky Point (5° 57′) it may be ascended by square-rigged vessels. Towards its mouth it widens to a mile, and where it enters the sea it is more than a mile and a half across. A bar of mud extends 4 miles out to sea, and can only be passed, by vessels drawing 9 feet, at half flood; but the channel along the eastern shore has 18 feet of water at high tide. This river runs more than 200 miles, and as it affords an easy means of transport for goods, there are many settlements on its banks.

Farther east runs the Berbice, whose source probably is situated near 3° 40′ N. lat. It has been ascended as far as a great cataract, which is south of 4° N. lat. Several other rapids and cataracts follow, but they cease at 4° 50′ N. lat., and from that point the river is navigable for 165 miles, measured along its numerous windings. The influence of the tide is perceptible nearly to this distance. Towards its mouth the river widens, but south of New Amsterdam it is not more than half a mile across. North of the town it gradually widens to 4 miles, where it meets the sea, in 6° 24′ N. lat. [Berbice.]

The Courantin river forms the boundary between the Dutch and British possessions. It has been ascended to 4° 21′ N. lat., where it forms two cataracts 100 feet high, and called Smyth Barrow Cataracts. Above them the river is still 900 yards wide, and hence it is inferred that its sources are much farther to the south, probably in the Sierra Acaray. From the great cataracts the river runs north and north-east till it reaches 5° N. lat., and in this part of its course there are several rapids. Near 5° N. lat. it turns east, and 12 miles from this point the rapids cease, and the river becomes navigable to the sea, a distance of about 150 miles measured along its windings. It runs 40 miles east nearly in a straight line, and then turns north. The remainder of its course is very tortuous, except towards its mouth. Seventy miles from the sea the tide rises 30 inches. At Oreála, 40 miles from its mouth in a direct line, it enters the low plain, and here it constantly preserves a width of a mile, which towards its mouth increases to 4 miles. North of 5° 55′ N. lat. it forms an æstuary, which is 10 miles across where it meets the sea. South of the æstuary is Parrot or First Island, which is 7 miles long and 1 wide, and divided from the eastern bank by a channel only 3 cables wide, but 9 feet deep at low-water. Along the

western shore is a mud bank, with 7 feet water over it at low tide, but in the middle of the river a channel with 8½ feet of water at low tide.

The upper course of the river Surinam, which traverses the middle of the Dutch territories, is not known; but if we may judge from the size of the river, its source cannot be much south of 4° N. lat., or in the parallel of the sources of the Berbice. It enters the low plain at about 4° 40′ N. lat., and so far it is navigable for river barges. Towards its mouth it increases to a mile in width, and north of Paramaribo it is still wider. Vessels of considerable size can enter it and sail up to that town.

The Marony, which divides the Dutch and French Colonies, resembles the Essequibo. Its upper course and origin are not known, but its size justifies the supposition that it rises at a great distance from the sea, probably in the Sierra Acaray. It is known that many rapids and cataracts occur in its bed south of 4° 45′ N. lat., the most northern of which is above Armina. From this place, to which the tide ascends, as far as its mouth, it is not less than 1½ mile wide, but full of islands. Large river vessels can ascend to Armina.

The Oyapoc, which divides the French territories from Brazil, has lately been explored by some Frenchmen, but satisfactory details of the survey have not yet been published.

Climate.—Guayana has two rainy and two dry seasons. The long rainy season sets in about the middle of April with frequent showers of short duration, which however increase as the season advances, until in the middle of June the rain pours down in torrents. In the beginning of July the rain begins to decrease, and in August it ceases entirely. The long dry season continues from August to November. December is showery, but in January much rain falls. February and March constitute the short dry season, but they are not quite so free from showers as the long dry season. During the rainy season it rains daily for some hours without cessation, and the remainder of the day is fine. A few days occur in the course of the season during which it does not rain at all. The heat is not so great as might be supposed, considering the position of the country near the equator and the lowness of the coast. The trade-winds, passing over the whole breadth of the Atlantic, reach this coast loaded with moisture, and both the wind and the moisture render the heat less oppressive. Besides this, there is the alternation of land and sea breezes, and as the sea-breezes are colder and blow in the day, and the land-breezes during the night, both greatly contribute to maintain a more equal temperature and to diminish the difference between the greatest and least degree of warmth within the twenty-four hours. The mean temperature of the low coast may be between 80° and 84°. The thermometer, even in summer, seldom rises above 90°, and it does not often descend below 75°. Though Europeans are subject to some diseases on their arrival, it is now well known that the climate of Guayana is more healthy than that of most places in the West Indies. Thunder-storms occur only during the rainy seasons, and are violent, but rarely do any damage. The hurricanes so destructive in the West Indies are entirely unknown. Slight shocks of earthquakes sometimes occur, but they never cause any damage. The more elevated parts of the country have the same seasons as the low coast, but they take place a month later, and the rains fall in much greater abundance.

Productions.—Few countries on the surface of the globe can be compared with Guayana for vigour and luxuriance of vegetation, which shows itself especially in the great number of indigenous plants and the large forest-trees which cover perhaps not less than one-half of its surface. Many of the trees produce excellent timber, others are used for furniture, as the mahogany, or afford dye-wood, and others are valuable on account of their fruits. Some are valued as being very ornamental, as the silk-cotton tree and the Mauritia vinifera.

Indian corn and rice are cultivated, and in some instances three crops of the former and two of the latter have been obtained in one year from some fertile pieces of ground. Wheat does not succeed, and Humboldt seems to have conceived a just idea of the country, when he says that no portion of the high lands in Guayana rises to such an elevation as to be fit for the cultivation of our cerealia. The roots which are most cultivated are cassava, or mandiocca, yams and sweet potatoes, and arrow-root. The chief fruits are the banana, the pine-apple, and the cacao-nut; the cabbage-tree grows wild.

Agriculture is principally directed to the cultivation of the articles of export. The sugar plantations are hardly inferior in extent to those in Barbadoes or Jamaica. Coffee and cotton are also cultivated to a great extent. Tobacco and indigo are at present less attended to. Ginger is one of the minor articles. Pepper, cloves, and nutmegs have been introduced by the French; the two first have succeeded, but the nutmeg-tree does not thrive well. The plant which produces castor oil grows wild, as well as the cacao-tree, and the tree from which arnotto is obtained.

The domestic animals are the same as in England. Black cattle grow to a greater size than in Europe, but their flesh is not so tender nor of so fine a flavour. The wool of the sheep is converted into hair. Among the ferocious animals are the jaguar and couguar. Other animals are the armadillo, agouti, ant-bear, the sloth, and a great variety of monkeys, and among them the howling monkey. Lizards are numerous and of various kinds; the iguana is common, and its flesh esteemed a delicacy, as well as its eggs. Alligators of great size are found in the larger rivers, and the manati, or sea-cow, is also sometimes met with. Among the bats, which are twice as large as those of England, are the vampires, which are said to suck the blood of persons when asleep. [CHEIROPTERA, p. 22.] Among the snakes, which are of different kinds and numerous, some are poisonous, and others distinguished by their size, as the boa constrictor. The pipa, a kind of frog, is remarkable for its hideous aspect, and for other peculiarities. [FROGS, p. 493-4.] Birds of several kinds are very numerous, as different species of parrots, mackaws, humming-birds, the flamingo, Muscovy ducks, toucans, spoon-bills, peacocks, &c. Of insects, as the scorpions, centipedes, cockroaches, termites, and other kinds of ants, the chigoe, or sand-flea, and the mosquitoes, are very troublesome.

Inhabitants.—Guayana is inhabited by Europeans, Africans, and native Americans. The Europeans are mostly descendants of Dutch settlers, but some are descendants of Englishmen and Frenchmen. The Africans were brought over to cultivate the country as slaves, and are much more numerous than the whites. In British Guayana there are six tribes of natives. The Arawaaks surround the settlements on the Demerara and Berbice rivers; the Accaways live on the banks of the Cuyuni and Mazaroony, and also on the Essequibo, north of 5° N. lat. Between the Sierra Pacaraima and Sierra Taripona are the Macoosie, and south of them the Warpeshana. The Warrows occupy the coast between the Pomaroon and the mouth of the Orinoco. Several Carib tribes are dispersed among the natives, and some of them are said to be cannibals. (*Lond. Geog. Journal*, vol. ii., p. 71.)

The natives of Guayana are much more civilized than the aboriginal tribes who inhabit the adjacent countries. They cultivate Indian corn, cassava, and some other roots, but they are still much attached to a wandering life, and a slight inducement, or sometimes only fancy, leads them to abandon a well cultivated piece of ground, and to remove to a wilderness, where they undergo much toil in rooting out the forest trees and in preparing a new piece of ground. The Arawaaks visit the British settlements, where they work in the wood-cutting establishments for daily wages, and are preferred to the negroes, as steady labourers. Some of the tribes are almost as fair as Spaniards or Italians, while those who live near the sea-coast are of a very dark brown, sometimes resembling the yellow-skinned negroes. But the straight, strong, black hair, small features, and well-proportioned limbs, always distinguish the Indian from the African.

Guayana is, as we observed, divided among Great Britain, Holland, and France.

I. *British Guayana* comprehends the countries extending from the Courantin river westward to the Orinoco, and from the sea-coast to the sources of the rivers Essequibo and Courantin, which have not yet been visited by Europeans. Its area probably does not fall short of 50,000 square miles. The most western portion, lying between the Orinoco and Pomaroon, a small river which falls into the sea about 20 miles west of the mouth of the Essequibo, is only inhabited by the tribe of the Warrows, and no European family is at present settled here. The settlements on the Pomaroon and Essequibo are few in number and not large; but the settlements along the banks of the Demerara and Berbice, as well as along the sea-shore between these rivers, are numerous, and extend from 30 to 50 miles inland. On the Courantin there are only a few settlements, but they are

rapidly increasing in number and extent. Sugar, coffee, and cotton are here cultivated on a large scale. Previous to 1831 the country was divided into three colonies, Essequibo, Demerara, and Berbice. but in that year they were united under one government, called British Guayana. The residence of the governor is in Georgetown, formerly called Stabrock (pron. brook), on the Demerara river, a short distance from its mouth. Its wide streets are traversed by canals. The houses are of wood, and seldom above two stories high. Before them are porticoes and balconies, shaded by a projecting roof, which is made of red wood, resembling mahogany. It contains about 10,000 inhabitants, of which rather more than one-half are negroes. New Amsterdam, on the river Berbice, not far from its mouth, is a small place. [Berbice.]

British Guayana, consisting of the colonies of Demerara and Essequibo, and Berbice, is under a governor-general and commander-in-chief, who includes in the same government the islands of St. Lucia and Trinidad. The actual administration of affairs is entrusted to a lieutenant-governor, who resides in Georgetown, Demerara, assisted by a legislative council, including the chief justice, high sheriff, attorney-general, and ten other persons. The administration of justice is confided to three chief-justices and four puisne judges in Demerara and Essequibo, and one puisne judge in Berbice. There are further 6 protectors of Indians, whose functions are sufficiently indicated by their designation, and 16 special justices, 11 in Demerara and Essequibo, and 5 in Berbice, who were appointed on the passing of the act for the emancipation of the slaves in 1834, and whose duty it is to watch over the execution of the law on behalf of the apprenticed population.

There has been no census of the population in Demerara and Essequibo since October, 1829, at which time there were—

	Males.	Females.	Total.
Whites, in country—Demerara	662	110	772
„ „ Essequibo	476	138	614
	1138	248	1386
„ in Georgetown, Demerara	962	658	1620
Total of whites	2100	906	3006
Free Coloured—in country—Demerara	463	617	1080
„ Essequibo	442	470	912
„ in Georgetown, Demerara	1625	2743	4368
Total free coloured	2530	3830	6360
Slaves, in country—Demerara	33,883	28,869	39,199
„ „ Essequibo			23,553
„ in Georgetown, Demerara	3209	3407	6616
Total slaves	37,092	32,276	69,368
Total population of Demerara and Essequibo	41,722	37,012	78,734

The free population of Berbice in 1836 was—

	Males.	Females.	Total.
Whites	431	139	570
Free Coloured	681	980	1661
Total	1112	1119	2231

The number of slaves in 1827 was 20,118
„ „ in 1833 19,320

The number of the negro population in British Guyana in respect of whom compensation was claimed and awarded under the act for abolishing slavery was—

Non-prædial, whose term of apprenticeship will expire August 1, 1838	6,297
Prædial, attached, August 1, 1840	57,807
Prædial, unattached „ „	5,475
Total for whom compensation was awarded	69,579
Children under 6 years of age on August 1, 1834,	9,893
Aged, diseased, or otherwise non-effective	3,352
Total slave population	82,824

The value put upon the entire slave population, computed from sales made between 1822 and 1830, was 9,489,559*l.*; and the compensation paid for the working classes out of the 20 millions awarded by parliament amounted to 4,268,809*l.*; that for the children and aged persons, &c., was 226,180*l.*

The quantity of exportable products raised in 1836 was—

	Demerara and Essequibo.	Berbice.
Sugar	85,982,756 lbs.	21,823,493
Rum	2,348,920 galls.	631,376
Molasses	3,491,991 „	543,578
Coffee	2,635,741 lbs.	3,239,991
Cotton	466,078 „	190,824

The exports of these products were made to various countries in the following proportions:—

Countries.	Sugar.			Rum.			Cotton	Coffee.	Molasses.
	Hhds.	Tierces.	Barrels.	Punchs.	Hhds.	Barrels.	Bales.		Casks.
United Kingdom	65,448	4348	3814	19,778	5202	1605	3176	1,489,550 lb. 3033 tierces. 1429 bags.	29,278
British N. American Colonies.	456	97	144	5,312	251	37	—	450 lbs and 6 bags.	6,402
British W. Indies	1,179	59	6	2,057	93	—	339	7300 lbs. 35 tierces. 10 bags.	1,377
Foreign Countries	411	173	34	954	88	5	—	208,450 lbs.	1,726
Total.	67,494	4677	3998	28,101	5634	1647	3515	1,705,750 lbs. 3068 tierces, 1445 bags.	38,783
Total Value	£ 1,529,918			£ 157,003			£ 40,149	£ 247,444	£ 160,865

The value of British goods shipped to Guiana in each of the five years from 1832 to 1836 was as follows:—

	Demerara and Essequibo.	Berbice.	Total.
1832	£337,263	£50,936	£388,199
1833	337,482	54,038	391,520
1834	410,764	52,687	463,451
1835	439,773	71,588	511,361
1836	601,781	96,214	697,995

The number and tonnage of vessels which arrived at and departed from the colony to various countries in 1836 were as follows:—

Countries.	Inwards.				Outwards.			
	Demerara and Essequibo.		Berbice.		Demerara and Essequibo.		Berbice.	
	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.	Ships.	Tons.
United Kingdom	194	55,372	46	11,542	212	58,328	45	11,518
British Colonies	266	25,869	108	8,657	275	27,442	125	10,074
United States	42	5,593	12	1,807	35	5,294	9	1,289
Foreign Countries	41	2,475	7	510	21	1,000	6	1,060
Total	543	89,309	173	22,516	543	92,064	185	23,941

The total revenue of the colony in 1836 was 120,900*l.*, and the total public expenditure 86,500*l.*, exclusive of 45,400*l.* incurred for military protection.

The coins current in the colony are British half-crowns, shillings, and sixpenny pieces, colonial moneys of the respective values of 3, 2, 1, ½, and ¼ guilders, and Spanish dollars, half-dollars, and quarter-dollars. There are no gold nor copper coins in circulation. Accounts are kept in Dutch currency of guilders and stivers: 20 stivers are equal to 1 guilder, and at the par of exchange $13\frac{11}{13}$ guilders are equal to the pound sterling. The actual rate of exchange fluctuates from 13 to 16 guilders per pound sterling.

II. *Dutch Guayana*, or *Surinam*, extends along the coast from the Courantyn river to the Marony, and between them inland to their sources, which are probably in the Sierra Acaray. The area of this country may be not much less than 30,000 square miles. Along the coast and along the banks of the rivers are many settlements and plantations, especially on the Surinam and Sarameca rivers. The Jews

are numerous in this country; and in the interior is a village, called Savanña, only inhabited by Jews, who cultivate their plantations. In the higher and hilly part are the Maroons, or runaway negroes, who have there formed a kind of political society: they formerly made incursions into the cultivated districts, but now live in peace, and receive some presents from the Dutch. This colony is partly the property of the town of Amsterdam. It exports sugar, coffee, cotton, and cacao. The population amounts to more than 60,000 souls, of which between 6000 and 7000 are whites, and more than 50,000 negroes. The capital, Paramaribo, about 10 miles from the sea, on the western bank of the river Surinam, is regularly built in the Dutch style, with a population of 20,000 inhabitants. The streets are wide and straight, and planted with orange-trees. The houses are generally two stories, and built of wood. There are some fine buildings in the town. Near it is the fortress Zelandia, in which the governor resides.

III. *French Guayana*, or *Cayenne*, extends along the coast from the river Marony to the Oyapock, which separates it from the empire of Brazil. It is not known how far it extends into the interior. Its area is stated to be 14,000 square miles. Nearly the whole tract, even along the sea-coast, is still covered with large forest-trees, and the settlements are neither so large nor numerous as in British and Dutch Guayana. The French export sugar, coffee, cotton, cacao, and arnotto. The capital is Cayenne, situated on the northern side of an island formed by the river Cayenne. It is a miserable place, with a population of about 2000 souls, and its harbour is shallow. On the mainland is the plantation La Gabrielle, where attempts have been made to transplant the pepper-vine, the clove tree, and the nutmeg-tree, from Asia to America. It seems that the two first thrive well, but the nutmeg tree has degenerated.

The population of French Guiana in 1834 was—

	Males.	Females.	Total.
Free persons, white and coloured	2,308	2,639	4,947
Slaves	9,240	7,896	17,136
Total	11,548	10,535	22,083
	Free.	Slaves.	Total.
Of the above the town population comprises . .	2,758	2,333	5,091
And there are on the plantations	2,189	14,803	16,992
Total	4,947	17,136	22,083

The number of births in 1834 was 547, and of deaths 709.

The number of plantations in the colony is stated in official returns as follows:—sugar 56, coffee 22, cotton 131, cocoa 6, cloves 48, arnotto 114, pepper 4, provisions 250; total 631. With the exception of the greater part of the sugar planters, who confine themselves to the production of that one article, there is hardly a cultivator in the colony who does not grow upon his estate more than one description of produce. In the foregoing enumeration each plantation is designated according to the branch of cultivation principally followed.

The value of goods imported in 1834, the greater part of which consisted of salt provisions and flour, was 68,999*l.* The exports in the same year amounted to 89,768*l.*; the value of the chief articles of export was—

Sugar .	£41,797
Coffee . .	1,750
Cloves . .	11,213
Arnotto . .	11,075
Cotton . .	15,149

The shipping that arrived at and left the colony in the same year were—

	Inwards. Ships.	Inwards. Tons.	Outwards. Ships.	Outwards. Tons.
French	28	4374	31	5032
Foreign	12		13	
	40		44	

History.—Guayana was discovered before the end of the fifteenth century, by Vincent Pinzon. The Dutch formed the first settlement about 1590, on the Demerara river, and afterwards at other places. The English settled, in 1634, in the neighbourhood of the Berbice and Surinam; but in 1667 the English settlements were given up to the Dutch. The French occupied Cayenne in 1633. During the last war with France the English occupied the Dutch settlements; and by the treaty of Paris, 1814, they restored only those between the Courantin and the Marony to the Dutch, retaining possession of the remainder. (Bolingbroke's *Voyage to the Demerary*, &c.; Von Sacks's *Reisen nach Surinam;* Hæfken's *Reize naar Guatemala;* Hillhouse and Schomburgk, in the *London Geographical Journal;* Waller's *Voyage in the West Indies*, &c.)

GUYENNE, or GUIENNE, and GASCOGNE, two provinces of France, forming together the largest of the thirty-two provinces, or military governments, into which under the old régime France was divided. The government, which was of very irregular form, extended about 245 to 250 miles in extreme length from east to west, from the eastern extremity of Rouergue to the shore of the Bay of Biscay, and about 205 to 210 miles in extreme breadth from north to south, from the northern extremity of Perigord to the Pyrenees. The area of Guienne, the northern province, was estimated at 15,847 square miles, and that of Gascogne, the southern, at 10,271 square miles, together 26,118; forming an area equal to more than half England, watered by the Garonne, one of the finest rivers of France, with its branches, the Tarn, the Lot, the Dordogne, and a number of smaller tributaries; and by the Adour, a considerable river, with some of its tributaries.

The military government of Guienne and Gascogne was bounded on the north-west by the province of Saintonge, on the north by the province of Augoumois, on the north-east by Limousin and Auvergne, on the east and south-east by Languedoc and Foix, on the south by the Pyrenees, by which it was separated from Spain, and on the west by the Gulf of Gascogne, or, as it usually termed by the English, the Bay of Biscay. The province of Béarn was surrounded by Gascogne on every side except the south; indeed Bearn, although it constituted a separate military government, was really a subdivision of Gascogne. [Bearn.]

Guienne and Gascogne were both divided into smaller provinces, and these again were subdivided with great minuteness. Of the principal divisions a table is given elsewhere. [France.]

The capital of Guienne was Bordeaux on the Garonne (population 98,705 in 1836); the other towns of some note were Libourne (pop. 9714 in 1836); Bazas (pop. 4446 in 1836); Perigueux (pop. 8956 in 1831); Agen (pop. 12,631 in 1831); Cahors (pop. 12,050 in 1831); Montauban (pop. 25,460 in 1831); Rhodez, or Rodez (pop. 8249 in 1831); Milhau (pop. 9806 in 1831); and Villefranche (pop. 9540 in 1831). The capital of Gascogne was Auch (pop. 10,461 in 1836); and the other towns of importance were Condon (pop. 7144 in 1836); St. Sever (pop. 5494 in 1831); Dax (pop. 4716 in 1831); Bayonne (pop. in 1831, including St. Esprit, which is in fact a suburb to it, 20,668); Pau in Béarn (pop. 11,285 in 1831); Tarbes (pop. 9706 in 1831); St. Bertrand de Comminge; and St. Lizier.

The province of Guienne is now comprehended in the departments of Gironde, Dordogne, Lot, Lot et Garonne, Tarn et Garonne, and Aveyron, and a small portion in that of Landes: Gascogne is comprehended in the departments of Landes, Basses Pyrénées, Hautes Pyrénées, Gers, and Haute Garonne, and some small portions in those of Lot et Garonne and Arriège.

Guienne derives its name from the Aquitani, one of the three great branches of the Gallic people whom Cæsar found in possession of Gaul. [France.] These Aquitani occupied the country south-west of the Garonne; but when Augustus divided Gaul into four provinces, he gave the name of Aquitania to the whole country from the Garonne to the Loire; the original country of the Aquitani becoming one of the subdivisions of the larger province, and taking the name of Novempopulana, or Novempopulania (*i. e.* the country of the Nine Nations), from the number of principal tribes by which it was occupied. In the decline of the Roman empire Aquitania (in the more extended application of the name) came into the hands of the Visigoths, who made Toulouse their capital, and extended their sway over Spain and Narbonnese Gaul; but in A.D. 507 Clovis king of the Franks having defeated and slain Alaric II. king of the Visigoths in the battle of Voiullé near Poitiers, wrested Aquitania from the Visigoths and brought it under the dominion of the Franks. That part of Narbonnese Gaul which was comprehended in the more modern division of Languedoc remained to the Visigoths, while their other

Gallic possessions passed to the Ostrogoths, who had established themselves in Italy. The Visigothic portion was diminished by subsequent encroachments of the Franks. In A.D. 630 the kingdom of Aquitania or (as in this stage of its history it is more generally written) Aquitaine was re-established in favour of Caribert or Charibert, son of Clotaire II., one of the Frankish kings of the Merovingian dynasty; but it was soon reduced from the rank of a kingdom to that of an hereditary duchy. Eudes duke of Aquitaine (A.D. 688—735) was possessor by inheritance or conquest of the whole country from the Pyrenees and the Ocean to the Loire and the Rhône, and even of some districts beyond the latter. He was defeated by Charles Martel and by the Saracens; but having made peace with the former, and assisted him in his great victory over the Saracens at Poitiers, A.D. 732, retained possession of his territories in all their extent. Waifre, grandson of Eudes, was defeated and despoiled of his territories by Pepin le Bref, king of France, A.D. 760—768. Hunold, his father, who had abdicated the duchy and retired to a monastery, quitted his retreat and attempted to uphold the fortunes of his house, but in vain. He was given up by his nephew Loup, or Lupus, duke of Gascogne, to Charlemagne, and the duchy of Aquitaine was extinguished.

The Gascons were originally a Spanish people. They had their seat between the Pyrenees and the Ebro, and in some tracts south of the river, in the modern Navarre and Aragon; and were called by the Romans Vascones. It is supposed by some that the Vasates, who are mentioned by Roman writers under a variety of names, and placed among the Aquitanian tribes, were a branch of the Vascones settled in Gaul, but this seems very doubtful. Toward the downfal of the Roman empire we find a portion of the Vascones settled in the south of Gaul, in the immediate neighbourhood of the Pyrenees, and it is probable that in their fastnesses they preserved their independence, and perhaps annoyed by their incursions the more exposed districts in the neighbourhood. It was not till A.D. 602 that they submitted to the Franks, to whom they became tributary. The Vascones have preserved in their mountain-holds unto the present time their language with little variation, and a considerable portion of their antient manners. Their name under various modifications may be traced in several modern designations—Biscay in Spain, the territory of the Basques in France, and in the more extended name of Gascogne, which appears in the Latin of the middle ages under the forms Vascitania, Vasonia, and Gasconia.

The Gascons were comprehended in the kingdom, afterwards the duchy, of Aquitaine, under Caribert and his successors; and though they remained near the Pyrenees, the name of Gascogne was given to the country between the Pyrenees and the Garonne. This district constituted a duchy, A.D. 768, under Loup or Lupus I., who gave up Hunold, duke of Aquitaine, to Charlemagne, as mentioned above. It was Loup II. (son of Waifre of Aquitaine, and grandson of Hunold), successor of Loup I., who surprised the rear-guard of Charlemagne on the return of that monarch from Spain, A.D. 778, by means of an ambush in the valley or pass of Roncevaux. Loup was soon after taken and hanged as a traitor; but the Gascons were continually in rebellion against the Carlovingian princes.

In the year 781 Charlemagne restored the kingdom of Aquitaine, and placed his son Louis le Debonnaire, then three years old, on the throne. On the death of Charlemagne Louis became emperor of the West, and was succeeded in Aquitaine by his son Pepin I., whose kingdom included not only the country to the south-west of the Loire, but a considerable territory on the right or north-east bank of that river. Pepin II., son and successor of Pepin I., had to struggle for the possession of his kingdom with his uncle Charles le Chauve, by whom he was deposed after a long contest which was maintained with various fluctuations of success, during which the people of Aquitaine shifted their allegiance with wonderful facility. On the deposition of Pepin II., Charles and Louis le Bègue, sons of Charles le Chauve, were successively kings of Aquitaine; but on the accession of the latter to the throne of France, on the death of Charles le Chauve, A.D. 877, Aquitaine was united to the French monarchy. The duchy of Gascogne continued after the extinction of the kingdom of Aquitaine, and its dukes exercised an authority independent of the kings of France.

Under the kings of Aquitaine the kingdom had been divided into fifteen counties: and a high functionary, under the title of the duke of Aquitaine, exercised some superior jurisdiction over the counts who governed them. The duchy of Aquitaine survived the kingdom, and became hereditary in the race of the counts of Poitiers. These nobles subsequently acquired the duchy of Gascogne, and consolidated under their sway a large territory in the south-west of France, including Poitou, Limousin, Guienne (excepting Quercy and Rouergue), and Gascogne; together with the suzerainty or feudal superiority of the county of Auvergne. This rich inheritance came by marriage into the possession of Henry Plantagenet, afterwards Henry II. of England, and, united with his Norman and Anjevin inheritance, rendered the English kings as powerful in France as the kings of France themselves. By the sentence of confiscation pronounced by the court of the peers of France against king John these domains were confiscated to the crown; and the sentence was partly executed by Philippe Auguste. A portion however of the duchy of Aquitaine, to which the name, under the corrupted form of the duchy of Guienne, was appropriated, extending from the Charente to the Pyrenees, remained to the English, and was governed by English noblemen sent over from time to time. It more than recovered its extent and splendour for a short time under Edward the Black Prince, but soon shrunk again in its dimensions, and in the years 1452 and 1453 was subjugated by the troops of the French king. [BORDEAUX.]

GUYTON DE MORVEAU, LOUIS BERNARD, a chemist of very considerable reputation, was born on the 4th of January, 1737, at Dijon, in the university of which his father was professor of civil law.

In very early life he showed a turn for mechanics, and after studying at home he went to college, which he quitted at 16 years of age; he then became a law student for three years in the university of Dijon, and afterwards repaired to Paris to acquire a knowledge of the practice of the law. At the age of 24 he had pleaded several important causes, and his father purchased for him the office of advocate-general in the parliament of Dijon; he soon afterwards was admitted an honorary member of the Academy of Sciences, Arts, and Belles-Lettres of Dijon. His taste for chemistry seems to have arisen from his attendance upon the lectures of Dr. Chardenon, who was in the habit of reading memoirs on chemical subjects; and, without neglecting the cultivation of literature, he applied himself to the study of Macquer's 'Chemistry,' and of Beaume's 'Manual of Chemistry,' which had been lately published.

In 1772, having previously published some less important papers, he gave to the world a collection of scientific essays, entitled 'Digressions Académiques;' the memoirs contained in this work on phlogiston, solution, and crystallization merit particular notice, and evince the superior knowledge which he had acquired on the subjects that he had undertaken to illustrate.

In the following year he achieved the important discovery of the means of destroying infection by acid vapours, and of all his labours it is this for which his name will be transmitted to posterity with those of the benefactors of mankind.

In one of the churches of Dijon a practice had prevailed of burying the dead in considerable numbers within its walls; this proceeding occasioned an infectious exhalation, which brought on a malignant disorder, to the great alarm of the inhabitants of the city. When other attempts to remedy this evil had failed, it occurred to Morveau that the vapours of muriatic acid might be successfully employed to remove it. With this view he made a mixture of sulphuric acid and common salt, in wide-mouthed vessels, which were placed upon chafing-dishes, and in different parts of the edifice; after closing the windows and doors for twenty-four hours, and then suffering the air freely to pervade the building, no remains of the fetid smell were perceptible, and the church was cleared from infection. The same process was tried on other occasions, and the practice is still continued, with the improvement of substituting chlorine gas for muriatic or hydrochloric acid gas. [FUMIGATION.]

Although this was probably the first employment of muriatic acid gas as a disinfectant on a large scale, and with results so striking as those detailed, it appears nevertheless, that Dr. Johnstone of Worcester had recommended the use of the same gas for this purpose in the year 1756; it is even stated that he employed it in the prison of Worcester, but we do not remember that any evidence exists of his

having published his process before the appearance of Morveau's tract on the subject.

In 1766 Morveau commenced a course of lectures on chemistry in Dijon, which appear to have given great satisfaction, being delivered with clearness and illustrated by numerous and striking experiments. His fame now began to extend to every part of Europe; and in the year following he published the first volume of a course of chemistry, entitled 'Elémens de Chimie de l'Académie de Dijon:' the work was completed in four volumes. This publication was received with great approbation.

He afterwards undertook to supply the chemical articles for the 'Encyclopédie Méthodique;' the articles *acide, adhésion*, and *affinité* contain a vast body of information clearly drawn up. It is to be regretted that, for reasons which are not known, he discontinued his connection with this work.

Feeling the reformation required in chemical nomenclature on account of the establishment of the antiphlogistic theory, and of the numerous new facts which had been discovered, he published a paper in the 'Journal de Physique' for 1782, to show the necessity of establishing a new and scientific nomenclature. This memoir undoubtedly had a great share in producing the change so greatly desired, and indeed rendered absolutely necessary by the vast accumulation of facts.

On the breaking out of the French Revolution he became a decided friend to the popular cause, and was a member of the Constitutional Assembly and of the Council of Five Hundred.

In 1799 Bonaparte appointed him one of the administrators-general of the mint, and in the year following director of the Polytechnic School; and after being an officer of the Legion of Honour he was created a baron of the French empire in 1811. At an advanced period of life he married Madame Picardet, the widow of a Dijon academician: he left no children. After teaching about 16 years in the Polytechnic School he gave up the appointment; and after about three years' retirement he died on the 3rd of January, 1816.

The publication of Morveau on chemical subjects are very numerous, and few of his contemporaries contributed more to the advancement of the science; it must however be confessed that he was not the author of any striking or fundamental chemical discoveries. His papers may be found in the 'Memoirs of the Dijon Academy,' the 'Annales de Chimie,' and the 'Journal de Physique.'

GUZERAT, or GUJERAT. [HINDUSTAN.]

GYALL, the name of the Indian Jungle Bull, *Bos frontalis* of Lambert. [OX.]

GY'AROS, one of the smaller Cyclades, situated nearly at an equal distance between Andros, Ceos, and Syros. It is about four miles long, and three miles in its greatest breadth, and is rocky and barren. It is now called Ghioura, and is not inhabited, except occasionally by fishermen. Under the Roman emperors it was used as a place of banishment, and is so mentioned by Juvenal (x. 170) and other writers. [BANISHMENT.]

GYGES. [LYDIA.]

GYLONGS. [BOOTAN, vol. v., p. 170.]

GYMNASTICS, or more properly *gymnastic* (γυμναστική, from the word γυμνός, *naked*; it being customary among the Greeks to strip themselves, wholly or in part, before engaging in exercises). The first notice of their employment is found in the second book of the 'Iliad,' where the Grecian soldiers are described as having disembarked from the ships and playing at quoits and javelin-hurling on the beach; and again, in the twenty-third book Achilles is represented as instituting games in honour of Patroclus, whose funeral ceremonies had just been performed, and as bestowing rewards on the victors in chariot-races, boxing, wrestling, quoit-throwing, &c. At this time they seem to have been principally practised as combining amusement with the best means of obtaining bodily strength and activity; but at a later period games were dedicated to the Gods, and, being regularly established, were conducted with the greatest ceremony; honourable rewards and civil distinctions were publicly bestowed on the conquerors, the chief of whom were deemed in no slight degree exalted above their fellow-citizens. These rewards being called *athla* (ἆθλα), gave origin to the name of *athletæ* (ἀθληταί), applied to those who contended for them; a designation adopted by the Romans, and from their language introduced into our own and others of modern Europe.

It was just before the time of Hippocrates, as Plato in the third book of his 'Politeia' tells us, that gymnastic was made a part of medicine, as a means of counteracting the bad effects of increasing luxury and indolence. It was gradually reduced into a complete system: public buildings called gymnasia were erected for the purpose, and superintending officers appointed by the state.

The first gymnasia were built by the Lacedæmonians (Plato, Νόμοι, lib. i.), and after them by the Athenians, who had three in the immediate neighbourhood of their city: one, called Academia, where, attracted by the pleasant walks which surrounded it, and the concourse of people of all classes who daily resorted thither, Plato was in the habit of holding his conferences with his pupils; another, named Lyceum, in which Aristotle taught; and a third, called Cynosarges, which was frequented only by the lower orders. Those built by the Romans were on a more magnificent scale, and from the extensive baths which were attached to them are not unfrequently called Thermæ.

The exercises practised in the gymnasia were the following:—

Dancing, which was of various kinds. In some the movements were much like those of modern tumblers; in others balls of various sizes were thrown about in regular time from one person to another; in others various figures and actions were gone through in imitation of battles, sieges, &c., in which the military engaged in full armour. From the second kind many of the games with balls seem to have been derived, of which in the Roman gymnasia a very great variety was practised.

Wrestling.—This, like the former, was practised alike in the gymnastics of the military, of the athletæ, and of those who merely used the exercise for the sake of health. Galen however disapproved of it as too dangerous for the last purpose, for he says that fractures and dislocations were no unfrequent consequences of it. The practice seems to have been much like that of modern wrestling; in one kind, the proper *Lucta*, the endeavour of each combatant was merely to bring his adversary to the ground; in the other, called *Pancratium volutatorium*, the combatants lay down and struggled on the ground, where each endeavoured to keep the other below him.

Boxing.—The use of boxing seems to have been confined to the gymnastic practices of the military and the athletæ, for neither Galen nor any other writer on medical gymnastics recommends it. It was practised naked, either with the open or clenched hands, or with brazen or stone spheres held in them (whence σφαιρομαχεῖν), or with the cæstus, which consisted of a leathern band studded with metal knobs, wound several times round the hands and wrists. A mixed exercise of boxing and wrestling (like modern boxing) was also practised under the name of *Pancratium*, but, like the two of which it was composed, it formed no part of the medical gymnastics.

Running.—This formed a part of all gymnastic exercises, and was strongly recommended by Plato (Νόμοι, viii.) to be practised not only by men, but by youths and even women, as of the greatest value in times of war.

Leaping.—There were various kinds. Besides jumping upwards and horizontally, they used to practice springing from their knees, and with heavy weights called *haltères* (ἁλτῆρες), which they carried in their hands, or on their heads or shoulders, or even on their feet in the form of leaden shoes. Sometimes they raced for a long distance in jumping towards a goal; and they had a game (as mentioned by Virgil, *Georg*. ii.) in which they jumped with naked feet on skins filled with wine and well oiled: here the object was to maintain the upright position on alighting on this slippery footing. He who could accomplish this most frequently, received the prize, while no little amusement was excited by the constant falls of the unsuccessful.

Quoits.—This game was used by all classes. The discus, or quoit was a round lens-shaped piece of stone, iron or brass, about three or four fingers thick, and nearly a foot in diameter, which was projected under-hand. (See the figure of the Discobolus in the Townley Gallery, Brit. Mus.) There was also an exercise similar to quoit-throwing, in which the *haltères* were employed. They were round bars of metal, somewhat contracted in the middle (very like a modern dumb-bell), which were either hurled about and caught alternately by the players, or were used by striking them one against the other, or merely by throwing about the arms, or keeping them extended while thus loaded.

Hurling.—In this the dart-javelin and many other missiles were thrown over-hand, the object being, as with the quoit, to hurl to or beyond a certain distance. Plato recommends that even women should practise it, as being useful in war. In addition to these exercises, which formed the regular business of the gymnasium, and which were conducted under the especial direction of the state, numerous others were practised by the Greeks and Romans, either at their public games, or as private amusements conducive to robust health, as riding, driving, swimming, rowing, climbing of ropes, swinging, mock-fights of various kinds, standing erect for a lengthened period, holding the breath, shouting, &c. The use of baths too formed an important part of their hygiène: they were attached to all the gymnasia, and were invariably employed after exercise. There were, as at the present time, hot, tepid, and cold baths; the last were most frequently resorted to, but after severe exertion it was often deemed best to go first into the hot bath and then immediately to plunge into cold water, a practice which is still very generally pursued in Russia. Anointing was also employed by those who engaged in the wrestling or the pancratium; the material was either simple oil, or oil mixed with water, or with dust and wax. After anointing, fine sand or dust was sprinkled over the body, that it might give a firmer hold, and for this the finest sand was brought from the banks of the Nile, as the best material that could be employed. Various officers were appointed to conduct the exercises of the gymnasium. At Athens the chief officer was called gymnasiarchus. It was his duty to superintend the whole establishment and all the exercises; while the xystarchus superintended the more athletic only of the exercises. There was also the gymnastes, who, being skilled in medicine, was required to prescribe the kind and extent of exercise which each was to use, and under him was the pædotribes, whose place it was to wait on those exercising, to assist and instruct them, to dispense, as Galen says, the means which the gymnastes prescribed. There were also servants set apart to each set of exercises, and for anointing, for the baths, &c.

Various causes have operated to put an end to the practice of gymnastics as a part of education and as a means of maintaining health. The present mode of warfare, in which success depends so much more on the science of the commander and the knowledge of gunnery, of fortification, and other arts, than on the physical force of each combatant, has rendered the attainment of skill in each of the branches enumerated more necessary than great bodily strength or activity, and hence among the military gymnastic exercises are almost entirely superseded. The exercises of the athletæ are indeed preserved, and the art of training is probably even better understood in the present day than it was among the antients, though the censure which the philosophers then bestowed upon such training is just as applicable at the present day. Plato (*Politeia*, lib. 3) describes the athletæ as dull, listless, and stupid, and subject to numerous diseases, cultivating nothing but a robust body, and leaving the mind in complete neglect: and Galen ('De Morborum Temporibus') speaks of them as gluttonous and heavy, sleeping long and soundly, and seldom remaining in good condition for more than five years. The same remark might be made of the present race of pugilists, wrestlers, &c., and certainly the gymnastic exercises which form part of the system of modern training present nothing in the effects which they produce, either on the mind or body, that would make their general adoption desirable.

The same cannot be said of gymnastic exercises practised under proper control, as a means of insuring a robust habit of body, and through it a vigorous intellect, or of curing certain chronic diseases. In such estimation were they held for this purpose among the ancients, that both Plato and Aristotle thought no republic could be deemed perfect in which gymnasia were neglected as part of the national establishments; nor did they estimate their value too highly. The observation of every day plainly shows how great an influence the mind and body mutually exert on each other, and if the care and cultivation of the former be a subject deserving the especial attention of the state [EDUCATION], the proper training of the latter should undoubtedly at the same time form a part of every system of education. It is however not only necessary that exercises or gymnastics should be a part of education, but it is also necessary to provide that the gymnastics should be proper in kind and in degree, in conformity with the judicious observations of Aristotle (*Polit.*, lib. 8).

The principle on which gymnastic exercises act is evident: their immediate effect is an increase both in the size and power of the parts exercised, in consequence of an admirable law which obtains in living bodies, that (within certain limits) in proportion to the exertion which it is required to make, a part increases not only in strength and fitness, but also in size. Instances of the application of this law may be seen daily. A person is called on to engage in some new avocation, in which muscular exertion is required, and every day he is not only improved in strength and dexterity, but the muscles brought into unusual action increase rapidly in size and vigour, so as soon to surpass those of the rest of the body which have been less employed. Nor does the beneficial influence stop here. If the exertion be not carried so far as to produce excessive fatigue, all other parts of the body sympathize with the improving condition of that which is chiefly exerted; the circulation, excited from time to time by the exercise, acquires new vigour, and the blood being thrown with unusual force into all parts of the system, all the functions are carried on with increased activity; an improvement in the general health is soon manifested; and the mind (if at the same time judiciously cultivated) acquires strength, and is rendered more capable of prolonged exertion. As instances of the bad effects of a deficiency of exercise, it will be sufficient merely to allude to the condition of those who, being compelled to a sedentary occupation during the greater part of the day, neglect to occupy a part of their leisure time in some active exertion, as walking, riding, &c.

But perhaps still more injurious effects are seen in large schools of girls, and especially in those in and about the metropolis. The fashion which prescribes a long list of so-called accomplishments as essential to the education of ladies, each of which requires a portion of the day, has left little or no time for bodily exercise of any kind; and the want of attention to this necessary condition of health has produced a great part of the diseases to which young females are subject. It would be difficult to say how else it is that the proportion of girls who are affected by curvature of the spine and other deformities is so much greater than that of boys of the same age and condition in life. Dr. Forbes (*Cyclopædia of Practical Medicine*) mentions the case from his own observation of a boarding-school in which 'there was not one girl who had been there two years that was not more or less crooked.' He adds, 'scarcely a single girl that has been at a boarding-school for two or three years returns home with unimpaired health.' If the condition of boys at boarding-school be compared with this statement, the conclusion is unavoidable that the exercise allowed to young females is not only insufficient as regards the time devoted to it, but of too restrained a nature. Its ill effects indeed, when they first become evident, are very generally increased by the use of various means for supporting the parts which are supposed to be weakened, and for maintaining them in a passive condition of rest; whereas the only means by which their healthful vigour can be restored is their judicious exercise. A system of proper exercises would undoubtedly be beneficial, not only to the body, but to the mind; and the loss of the time, before devoted to study, would be fully compensated by the increase of mental activity which the pupils, healthy and robust, would then bring to their studies.

Excessive exercise, on the other hand, should be carefully avoided: for though less frequent, instances are not uncommon where undue exertion has produced effects scarcely less injurious than those which result from inactivity. The existence of either class of evils is sufficient to prove that gymnastics should form a part of the education of youth, as much as 'literary instruction, music, and the art of design,' which with 'gymnastic' are mentioned by Aristotle (*Polit.* lib. viii.) as the four branches of instruction recognised in his day. In order that gymnastics may produce their proper results, some general system should be established in all schools, by which one sex may be preserved from the evils of deficiency, and the other from those of excess in exertion; and the beneficial influences which gymnastics exercise on the mind as well as on the body, on the understanding and moral habits as well as on the health and strength, may be secured to both.

(Plato, *Polit.*, lib. iii.; *Laws*, lib. viii.; Galen, *De Tuendâ*

Valetudine; Hieronymus Mercurialis, *De arte Gymnasticâ libri sex*, Venetiis, 1587.)

GYMNOCE'PHALUS. [CORACINA, vol. viii., p. 4.]

GYMNODA'CTYLUS. [GECKO, vol. xi., pp. 103-105, 106.]

GYMNO'DERUS. [CORACINA, vol. viii., p. 4.]

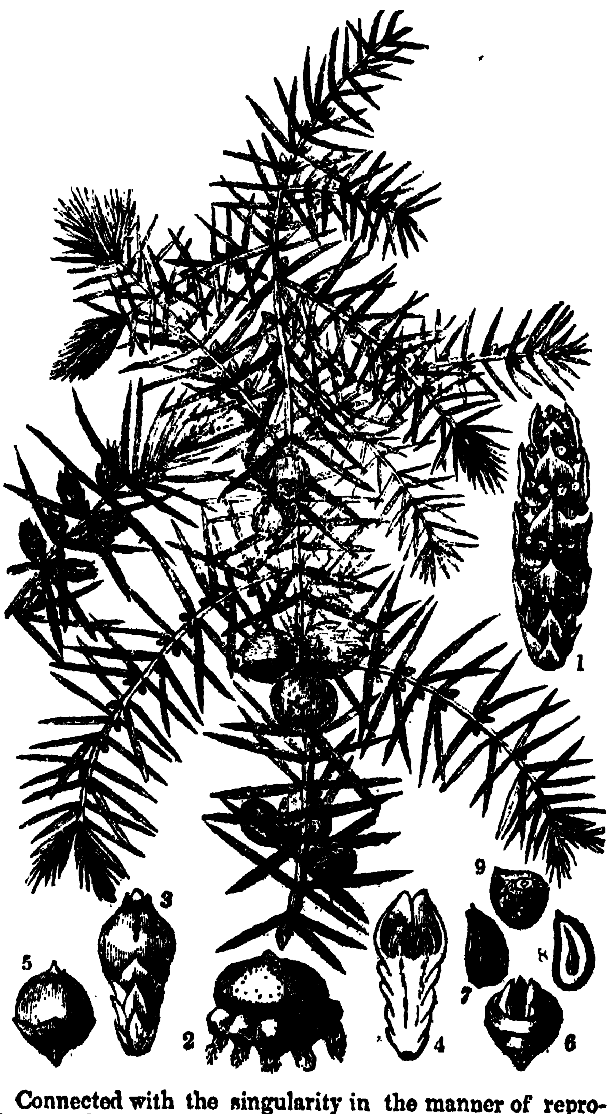
GYMNO'LEPAS. [CIRRIPEDA, vol. vii., p. 207.]

GYMNOPS, a genus of birds (*Goulins*) established by Cuvier and described by him as having a bill strong as that of the Orioles; the nostrils round, without scales or any membranous *entourage*, and a great part of the head denuded of feathers. He refers to *Gracula calva*, Gmel., *Mino Dumontii*, Less., and *Gracula cyanotis*, Lath. (*Merops cyanotis*, Sh.), as examples.

GYMNOSOPHISTS. [HINDUSTAN.]

GYMNOSPERMS, one of the five divisions under which the vegetable kingdom is now classified. The name is derived from the seeds being naked, that is to say, unprotected by a pericarpial covering, and fertilized by the pollen coming in direct contact with the ovule, not by the intervention of the apparatus called stigma and style. In this respect Gymnosperms are analogous to those reptiles which, in the animal kingdom, have eggs that are impregnated by the male after they have been deposited by the mother.

The number of plants in which this peculiarity exists is inconsiderable; they entirely belong to the natural orders Coniferæ in its most extensive sense, and Cycadaceæ. Equisetaceæ perhaps have to be added, but this is a point at present involved in doubt.



Connected with the singularity in the manner of reproduction, from which the class of Gymnosperms derives its name, is a point in the organization of the organs of vegetation equally remarkable. Although Gymnosperms contain the most gigantic trees which exist upon the face of the earth, they are nevertheless so ill provided with spiral vessels that it is in fact doubtful whether they possess any properly so called, and their vascular organization is in all respects exceedingly low and imperfect.

In their manner of growth Gymnosperms correspond on the one hand with Exogens, the wood of Coniferæ being arranged in concentric circles, and on the other with Endogens, the wood of Cycadaceæ being very nearly like that of a palm-tree. In fact the class of Gymnosperms may be considered to unite the two classes of Exogens and Endogens so perfectly that not a link remains to be supplied. They also closely border upon Acrogens, of which Cycadaceæ have the gyrate vernation, Coniferæ the veining, and in some cases the peculiar arrangement of the male apparatus.

In addition to the differential characters of these plants we have to add that their sexes are always separate, and that their leaves, if furnished with veins at all, have them parallel as in Endogens, or forked as in ferns, and never reticulated as in the class of Exogens.

The preceding figure of Juniperus Oxycedrus will show the peculiarities of this class:—*Fig.* 1 is a male catkin; *fig.* 2, a scale from it having anthers on its under side; *fig.* 3, a female cluster of flowers seated at the end of a scaly peduncle; *fig.* 4, a longitudinal section of the same, showing the naked ovules seated within the scales; *fig.* 5 is a ripe fruit, composed of three scales, become fleshy and consolidated, and burying the seeds within their centre; *fig.* 6 is the same fruit divided transversely, to show how the seeds are placed within the ripe fruit; *fig.* 7 is a seed; *fig* 8, a longitudinal, and *fig.* 9, a transverse section of the same.

GYMNO'TUS, a genus of fishes of the section Apodes. Generic characters:—Gills partially closed by a membrane and opening before the pectorals; the vent placed very far forwards; body without any perceptible scales, and without dorsal fin; anal fin extending the greater part of the length of the body.

Gymnotus electricus (Linn.), from the resemblance it bears to an eel, and the electric power which it possesses, has been called the electric-eel. It is about five or six feet in length; the head is rather broad and depressed; the muzzle is obtuse; the body, compared with that of the common eel, is stouter and shorter in proportion; the anterior part is nearly cylindrical, but towards and at the tail it is compressed; the pectoral fins are small and rounded; the anal fin commences at a short distance behind the line of the pectoral fins, and extends uninterruptedly to the tail; there is no caudal fin. Its colour is brownish-black.

The electric-eel is said to communicate shocks so violent that men and even horses are overpowered by them. This power is dependent on the will of the animal, but decreases in strength if frequently repeated, unless at considerable intervals. The organs by which this shock is produced are minutely described by Hunter in the 65th volume of the 'Philosophical Transactions.' All the species of Gymnotus inhabit the rivers of South America.

The genus *Carapus* of Cuvier contains such species of Gymnotus of the older authors as have the tail lengthened and tapering, and the body compressed and furnished with scales. They also inhabit South America.

GYMNU'RA. Dr. Horsfield and Mr. Vigors, in the number of the 'Zoological Journal' for April—September, 1827 (vol. iii.), state that in the 13th volume of the 'Linnean Transactions' an animal was described by the late lamented Sir Thomas Stamford Raffles, which he had acquired among his extensive zoological collections in Sumatra. A preserved specimen, according most accurately with his description except in size, apparently in consequence of its being young, was discovered among the numerous and valuable subjects with which he enriched the museum of the Zoological Society of London. This specimen Dr. Horsfield and Mr. Vigors caused to be figured in the 'Zoological Journal;' and, say the authors—'Since we first examined this animal we have been fortunate enough to discover in the same collection an adult specimen that had been preserved in spirits. We are thus enabled to give a perfect description of the species, and at the same time, having all the materials complete before us, to characterize the group to which it belongs, and which appears to us very distinct from any hitherto described.'

Sir Stamford Raffles referred the species to the Linnean genus *Viverra*, and recorded it as *Viverra Gymnura.* But although he did not nominally raise the animal to the importance of a genus, he gave so clear and accurate a

description of its generic characters that Dr. Horsfield and Mr. Vigors do not hesitate to attribute the first indication of the group to him; and they proceed to give the generic character of *Gymnura*:—

Dental formula: incisors $\frac{2}{6}$; canines (Laniarii), $\frac{2-2}{1-1}$; molars $\frac{8-8}{7-7} = 44$.

Incisors, 2 above, remote, very large, subcylindrical, rounded at the apex; 6 below, the four intermediate approximate, rather short, inclined (proclives) compressed, the anterior surface (paginâ) convex, the interior flat, edge rounded (scalpro rotundato), the two lateral abbreviated, acute. *Canines* (Laniarii), 2 on each side above, remote from the incisors and shorter than them, the anterior ones the longest; 1 on each side below, very large, conical, subarcuate, looking inwards. *Molars*, 8 on each side above, remote from the canines, the three anterior unicuspid, the first elongated and sectorial; the second and third abbreviated; the fourth with an elongated conical point and a posterior and exterior abbreviated lobe or step (gradu) at the base; the fifth with the exterior cusp very long, and the interior one abbreviated; the sixth and seventh very large, multicuspid, the cusps subabbreviated and rounded; the eighth smaller and more fashioned for triturating (subtritorius), the cusps rather obtuse; 7 below, the three anterior unicuspid, compressed; the first and second shorter; the third subelongated; the fourth with an elongated cusp, an anterior lobe, and another posterior lobe (gradu) abbreviated; the fifth, sixth, and seventh very large, multicuspid, the cusps rather elevated and acute.

Head elongated, acuminated, narrowed, compressed on the sides, flattish above. *Muzzle* (rostrum) obtuse, elongated, stretched forward (protensum) much surpassing the lower jaw in length. *Nostrils* lateral, prominent, with the margins convoluted. *Tongue* rather smooth, large. *Auricles* rounded, somewhat prominent, naked. Eyes small. *Whiskers* (vibrissæ) elongated.

Body rather robust, ground of the fur (cordaris) soft, but with distant erect, subelongated, harsh hairs. *Tail* rather long, smooth, attenuated, naked, scaly, with a few scattered hairs in youth.

Feet moderate, plantigrade, pentadactyle, the forefeet with a rather short thumb, the three intermediate fingers rather long and subequal; the hind feet with a very short great toe, the three intermediate toes very much elongated, and the external toe moderate. *Claws* moderate, narrow, curved, compressed, very acute, retractile.

Such is the character given by Dr. Horsfield and Mr. Vigors to *Gymnura*, and they state their opinion that the nearest affinity to this genus appears to be met with in *Tupaia* (Raffles). From that group however they say that *Gymnura* is sufficiently distinguished, besides the difference in the system of dentition, by the elongation of the *rostrum*, the comparative robustness of the body, the setose character of the hairs, which are sparingly mingled with the soft fur, the small retractile claws, and the nakedness of the tail. In general appearance they hold that the group bears a strong resemblance to some species of the *Marsupial* genus *Didelphis*.

Description of *Gymnura Rafflesii*.—Gymnura, with the body, feet, stripe above the eyes, scattered occipital hairs, and the basal half of the tail black; the head, the neck, the scattered hairs of the back, and the other half of the tail white. (Horsfield and Vigors.)

Dimensions of an adult Specimen. (H. and V.)

	ft.	in.	lines.
Length of the body and head from the extremity of the proboscis to the root of the tail	1	2	3
Length of the tail	0	10	6
„ the head	0	4	3
„ the proboscis	0	0	8
Breadth of the head across the ears	0	1	6
Distance between the eyes	0	1	0
Height at the shoulder	0	5	0
„ at the rump	0	4	6
Length of the anterior tarsus and toes	0	1	9
„ the posterior ditto	0	2	0

Gymnura Rafflesii. (Horsfield and Vigors, 'Zool. Journ.,' vol. iii.)

M. Lesson, whose 'Manual' bears the date of 1827, places the ninety-fourth genus, *Gymnura*, between the dogs with hyæna's feet (*Canis pictus*, Desm.; *Hyæna picta*, Temm.), and *Viverra*, Linn., the first subgenus of which he makes to consist of the true Civets. He says of *Gymnura*, 'We form this genus in conformity with the opinion (d'après l'avis) of M. Desmarest, in order to place in it an animal closely approximating to the Civets, and perhaps approximating still nearer to the *Paradoxuri*, which are plantigrade. We place it provisionally among the digitigrades. It has a pointed muzzle, a soft tongue, rounded ears, erect and naked, compressed claws, curved and sharp, a naked tail, and the following dental formula:—

'Incisives, $\frac{6}{6}$; canines, $\frac{1-1}{1-1}$; molars, $\frac{6-6}{6-6} = 40$.

'*In the upper jaw* the two middle incisives are the largest, and separated (écartées) one from the other; the two lateral ones are very small; the canines are moderate. The first molar has two points, the second one only; the fourth and fifth have four tubercles, the sixth has only three.

'*In the lower jaw* the canines are long.

'Species, *Gymnura Rafflesii*, *Viverra Gymnura*, Raffles. This species, from the East Indies, has the muzzle, which exceeds the lower jaw by an inch, pointed; the eyes are small, the moustaches long; the tail, which is naked, like that of a rat, is only ten inches long, and the head and body measure one foot. The fur consists of two sorts of hair, a short under fur (bourre) very thick and soft, and a long harsh hair; the body, legs, and first half of the tail are black; the head, the neck, and the shoulders are white; a black band passes over the eyes. Habits unknown.'

M. Lesson does not state from what specimen he has taken his descriptions, which vary from those of Dr. Horsfield and Mr. Vigors, in some instances essentially; but the latter state the ample materials from which they defined their characters.

Cuvier, in his 'Additions et Corrections' to the first vol. of his 'Règne Animal' (1829), takes no notice of M. Lesson's description, but, referring to page 126 of his own volume, says, 'The genus *Gymnura* of MM. Vigors and Horsfield (*Zool. Journal*, iii., pl. 8) appears to approach Cladobates in its teeth, and the shrews (musaraignes) in its pointed muzzle and scaly tail. It has five unguiculated toes on all its feet, and rather stiff bristles (soies assez rudes) projecting forth from the woolly hair. It cannot be well classed till its anatomy is known.'

The term *Gymnura* has been applied to designate a genus of sea-ducks; and Spix uses the word *Gymnuri* as the name of a family of South American monkeys. [FULIGULINÆ, vol. xi., p. 11.]

GYNA'NDRIA, one of the classes in the artificial system of botany invented by Linnæus, the character of which is to have the stamens and pistil consolidated into a single body. The principal part of the class consists of Orchidaceous plants, forming in it the order Monandria.

GYPA'ËTOS, Storr's generic name for the Laemmergeyer, or Bearded Griffin (*Gypaëtos barbatus*), a bird of prey which may be considered as intermediate between the eagles and the vultures. [VULTURIDÆ.]

GYPOGE'RANUS, Illiger's generic name for the *Secretary Bird*. Mr. Bennet, in the 'Tower Menagerie,' remarks that the singular conformation of this bird, so different in many respects from that of the order to which both in its leading characters and in its habits it obviously belongs, rendered it for a long time the torment of orni-

thologists, who puzzled themselves in vain to assign it a definitive place in the system, and could not agree even with regard to the grand division of the class to which it ought to be referred. 'Thus,' continues the author, 'M. Temminck was at one time inclined to refer it to the Gallinaceous order; and M. Vieillot, after repeatedly changing his mind upon the subject, at last arranged it among the Waders, with which it has absolutely nothing in common except the length of its legs. It appears however to be now almost universally admitted that its closest affinity is with the Vultures, with which it agrees in the most essential particulars of its organization, and from which it differs chiefly in certain external characters alone, which unquestionably give to it an aspect exceedingly distinct, but are not of themselves of sufficient importance to authorize its removal to a distant part of the classification. It constitutes in fact one of those mixed and aberrant forms by means of which the arbitrary divisions of natural objects established by man are so frequently assimilated to each other in the most beautiful, and occasionally in the most unexpected manner.' The 'Tower Menagerie' was published in 1829, and the uncertainty as to the true position of the bird does not seem to be entirely removed yet. One of the last writers on the subject, Mr. Swainson, in the first volume of his 'Classification of Birds' (1836), places the 'Secretary Vulture of Africa' among the *Vulturidæ;* but in the second volume of the same work (1837), he makes it a genus of the *Aquilinæ*, a subfamily of the *Falconidæ*.

Before we proceed to lay before the reader a sketch of the opinions of systematists, it may be advisable to give some account of the habits of the Secretary Bird, so that they may be borne in mind and applied to those opinions.

Habits.—Dr. Sparrman first saw this bird (a drawing of which, given by M. Vosmaer under the denomination of *Sagittarius*, he alludes to) in the neighbourhood of the warm baths of Hottentot Holland. 'It is not,' he says, 'a very shy bird, but when scared begins at first to endeavour to save itself by alternately hopping and scudding along very swiftly, and afterwards does it more effectually by flight. In external appearance, in some respects it resembles the eagle, and in others the crane, two birds certainly very unlike each other; though in my opinion it ought to be referred to neither of these genera. The Hottentots give it a name most suitable to its nature, viz., as translated into Dutch, *Slangen-vreeter* (or Serpent-eater); and in fact it is for the purpose of confining within due bounds the race of serpents, which in Africa is very extensive, that nature has principally destined this bird. It is larger than our crane, with legs two feet and a half long, and the body in proportion less than the crane's. Its beak, claws, stout thighs covered with feathers, and short neck, are like those of the eagle and hawk kind.' Then follows a particular description of the bird, after which the Doctor continues thus: 'This bird has a peculiar method of seizing upon serpents. When it approaches them it always takes care to hold the point of one of its wings before it, in order to parry off their venomous bites; sometimes it finds an opportunity of spurning and treading upon its antagonist, or else of taking it up on its pinions and throwing it into the air: when by this method of proceeding it has at length wearied out its adversary, and rendered it almost senseless, it then kills it and swallows it without danger. Though I have very frequently seen the Secretary Bird, both in its wild and tame state, yet I have never had an opportunity of seeing this method it has of catching serpents; however I can by no means harbour any doubt concerning it, after having had it confirmed to me by so many Hottentots as well as Christians; and since this bird has been observed at the menagerie at the Hague to amuse and exercise itself in the same manner with a straw. If, finally, this Serpent-eater is to be referred to the *Accipitres*, or the Hawk kind, the name of *Falco serpentarius* appears to be the most proper to distinguish it by in the *Systema Naturæ*. It has even been remarked that these birds, when tame, will not disdain now and then to put up with a nice chicken.'

Sparrman, it is true, did not himself see the scene which he describes; but that his account is correct in the main will not be doubted when we present the reader with a translation of the testimony of an eye-witness—of one at whose relations the devoted admirers of Buffon were too apt to smile incredulously, but whose accuracy is now generally allowed to be unimpeachable. We give it entire, because, even in those parts which are not directly illustrative of the habits of the bird, the difference between the actual observer, the field zoologist, who had studied nature in her own wildernesses, and the cabinet theorist, who had only viewed her through the false medium of his own brilliant but delusive imagination, is strikingly displayed. Le Vaillant, in one of his journeys in the Namaqua country, arrived at a spring at the very moment when a *Secretary* was drinking there: he killed it at the first shot, and gave to the well the name of the *Secretary's Fountain*. His narrative then proceeds as follows:—

'The Dutch have named this bird the *Secretary*, on account of the tuft of plumes which it carries at the back of the head; for, in Holland, clerks (gens de cabinet), when they are interrupted in their writing, stick the pen among their hair behind the right ear, so as to imitate in some degree its crest. Buffon, speaking of it, says that it has only been known at the Cape recently; and the proof which he adduces is, that Kolbe and other succeeding writers say nothing of it. This is advancing a groundless assertion (un fait faux), and endeavouring to prove it by another as true as the first. The Secretary is known in the Colonies both under the name of *Secretaris* and that of *Slang-vreeter*. It is under this last denomination that Kolbe speaks of it; and he certainly knew it, at least from the relation of others, because he exactly enumerates all the kinds of food which it habitually takes. It is true that, in his description, he translates the Dutch word *Slang-vreeter* by the French word *Pélican*, and that consequently he makes a single species out of two very different ones. But Kolbe was no naturalist, and his work contains so many other errors that it would be astonishing not to find this. I have been more surprised, I confess, to see that our modern naturalists, even those who have spoken of the Secretary in the greatest detail, make no mention of three bony and blunt protuberances which it has at the bend and last joint of the wings, but infinitely less apparent than in the Jacana or in the Kamicki. This omission has appeared strange to me, in Buffon particularly, who has not described it from the relation of others, but from an individual which he had before his eyes, and which I believe was in the cabinet of Mauduit. It is nevertheless an essential omission, because it deprives the Secretary of one of its principal distinctive characters, and because the protuberances of which I speak form one of the arms of the bird, as I shall presently show. I shall permit myself moreover to make a remark on what Buffon has written. According to him the Secretary differs from other birds in its timid nature; and its timidity is even such, says he, that when attacked by its enemies it has no other resource for its preservation excepting flight. This is an error. Those who have been able to study this bird know that, living especially on reptiles, it is continually at war with them; that it seeks them everywhere, and attacks them courageously. For this assertion I cite the testimony of Querhoent, and bring forward in proof of it the fact which I have witnessed.

'In descending from a mountain into a very deep bog (fondrière), I perceived, nearly perpendicularly below me, a bird which raised and lowered itself very rapidly, with very extraordinary motions. Although I well knew the Secretary, and had killed many of these birds at Natal, it was impossible for me to recognise it in the vertical situation in which I found myself, and I only suspected that it was one from its bearing. Having found means, by favour of some rocks, to approach sufficiently near, noiselessly and without being discovered, I found that this bird was a Secretary combating a serpent. The fight was very sharp on both sides, and the skill (la ruse) equal on the part of each of the combatants. But the serpent, which perceived the inequality of its strength, employed that adroit cunning which is attributed to it, in order to save itself by flight and regain its hole; while the bird, divining its intention, stopped it at once, and throwing itself before the serpent by one spring, cut off its retreat. Wherever the reptile essayed to escape, there it always found its enemy. Then, uniting skill with courage, it erected itself fiercely to intimidate the bird, and presented, with a frightful hiss, a menacing gape, inflamed eyes, and a head swollen with rage and poison.

'Sometimes this offensive resistance suspended hostilities for an instant; but the bird soon returned to the charge; and covering its body with one of its wings as with a shield, struck its enemy with the other, with the bony protuber-

ances of which I have already spoken, and which, like small clubs, overpowered it the more surely, inasmuch as it presented itself to the blows. In effect, I saw it reel and fall extended: then the conqueror threw himself upon it to finish his work; and with one blow of the bill split its skull.

'At this moment, having no further observations to make, I killed it. I found in its crop (for it has one, which nobody has stated), on dissecting it, eleven rather large lizards, three serpents as long as one's arm, eleven small tortoises very entire, many of which were about two inches in diameter, and, finally, a quantity of locusts (sauterelles) and insects, the greater part of which were sufficiently whole to deserve being collected and to be added to my specimens. The lizards, the serpents, and the tortoises had all received the stroke of the bill on the head. I observed besides, that independently of this mass of aliments the craw (poche) of the animal contained a species of pellet, as large as a goose's egg, and formed of the vertebræ of serpents and lizards which the bird had devoured previously, scales of small tortoises, and the wings, feet, and corselets of different scarabæi. Doubtless when the undigested mass is become too large, the Secretary, like other birds of prey, vomits it and gets rid of it. It results from the superabundant quantity of nourishment which this specimen had secured, that in attacking the serpent of the bog, it was not hunger which had stimulated it to the combat, but the hatred and antipathy which it bears to these reptiles. Such an aversion as this is of an inappreciable advantage in a country where the temperature wonderfully favours the multiplication of an infinity of noxious and venomous animals. In this point of view the Secretary is one of nature's real benefactions; and indeed its utility and the services rendered by it are so well recognised at the Cape and in its neighbourhood, that the colonists and Hottentots respect it and do not kill it: herein imitating the Dutch, who do not kill the stork, and the Egyptians, who never injure the ibis.

'The Secretary is easily tamed, and when domesticated, every kind of nourishment, cooked or raw, agrees with it equally. If care be taken to feed it well, it not only lives amicably and peaceably with the poultry, but when it sees any dispute going on it runs to separate the combatants and to restore order. It is true that if it be permitted to suffer from hunger, it provides for itself, and then falls without scruple upon the ducklings and chicks. But this abuse of confidence, if abuse of confidence it can be called, is nothing but the imperious effect of want, and the pure and simple exercise of that necessity which devotes the half of all that breathes to the appetite of the other half. I have seen tame Secretaries at many houses. The eggs ordinarily amount to from two to three, nearly as large as those of a goose, and white like those of a hen. The young remain a long time before they quit the nest, because their legs being long and slender, they sustain themselves with difficulty. They may be observed, even up to the age of four months, unable to progress except by leaning on their heels; which gives them a strikingly clumsy and ungraceful air. Nevertheless, as their toes are not so long nor their claws so curved as the other birds of prey, they walk with much more facility than those. So that when they have attained the age of seven months they may be seen to develop easy and graceful movements which suit well with their noble bearing. Buffon, quoting the Dutch naturalist, says, that when the latter was drawing his Secretary, the curious bird came to look upon the paper with outstretched neck and upstanding crest, as if admiring its likeness, &c. Certainly the Secretary is sufficiently interesting on account of its instinct and natural qualities, without requiring to be gifted by its historian with an admiring taste for drawing and a sort of pride at seeing itself represented. If Vosmaer's Secretary approached him, stretching out its neck and raising its crest, it was, in my opinion, neither from curiosity nor delight, but only from a sort of habit which is common to many other birds. We know that the majority of them, when they are familiar and domesticated, love to have their polls scratched; that this titillation seems to give them pleasure; and that they present themselves to the first comer and stretch out their neck to beg for this service. We see this in Europe with reference to the peacock and the parrakeet.

'The Secretary is found on all the arid plains in the neighbourhood of the Cape. I have found it in the East, on the whole line of coast, in Caffraria, and even far inland. But in the west, although this part of Africa presents deserts still more arid than those of the East, and although it consequently offers to the bird the different sorts of food which are congenial to it, I have never met with one beyond the country of the Great Namaquas. I will add only one word on this interesting animal: it has not the bill of a gallinaceous bird, as Vosmaer says it has; but a true bill of a bird of prey. Nor has it, as Buffon declares, the leg bare of feathers like the shore birds (oiseaux de rivage). For the rest, I refer to my 'Ornithology,' where I shall enter into greater details on the subject of the Secretary.' (Le Vaillant, *Second Voyage dans l'Intérieur de l'Afrique*, &c., tom. ii.

M. Lesson quotes the account of Mr. Smith, who relates that one day he saw a Secretary take two or three turns on the wing at a little distance from the place where he was. The bird soon settled, and Mr. Smith saw that it was attentively examining an object near the spot where it had descended. After approaching it with great precaution the Secretary extended one of its wings, which the bird continually agitated. Mr. Smith then discovered a large serpent raising its head, and appearing to wait the approach of the bird to dart upon it; but a quick blow of the wing soon laid it prostrate. The bird appeared to wait for the serpent's raising itself, in order to repeat the blow; but this the serpent, it seems, did not attempt, and the Secretary walking towards it, seized it with the feet and bill, and rose perpendicularly into the air, whence the bird let the serpent fall on the ground,' so that it might be securely destroyed.

Gmelin placed the Secretary (*Secrétaire* and *Messager* of the French) at the head of the genus *Falco*, and in the first division (*femoribus longissimis*), immediately after the genus *Vultur*.

Lacépède arranges the bird, under the name of *Serpentarius*, at the head of his 'Oiseaux de rivage,' with the Kamichi (*Palamedea*) and *Glareola*; which three genera constitute his thirty-first order.

M. Duméril makes the order of Rapacious birds (his first) contain three families; and, in the second family (Plumicolles, or Cruphodères), the Secretary is found, together with the genera Griffon, Eagle, Buzzard, Autour (*Astur*, *Goshawk*), and Falcon.

Illiger's *Raptatores* form his third order, and *Gypogeranus* appears in the Accipitrine section of that ornithologist in company with *Falco* and *Gypaëtos*. The Accipitrine birds are followed immediately by the Vulturine section; the remaining section (the first) consists of the Nocturnal Birds of Prey (*Strix*).

Baron Cuvier arranges the form among the Falcons.

M. Vieillot places the Secretary (*Ophiotheres*) in the *Uncirostral* family of the *Tetradactylous* tribe (the second) of the *Grallatores*.

M. Temminck, finally, refers the bird to his first order—the Rapacious Birds.

M. de Blainville (1815, 1821, 1822) divides the Raptatores into Diurnal and Nocturnal. The Diurnal he separates into two sections—the first, *The Anomalous* (The Secretary), the second, *The Normal* (Falco, Linn.). But in the further development of M. de Blainville's arrangement by his pupil M. Lherminier (1827), the birds are divided into two subclasses—the first, *Normal*, the second, *Anomalous*. The Secretary here appears as the second family of the Normal subclass; the first being the *Accipitres*, (Linn.), and the third *Strix*.

M. Latreille places the Secretary in his second family of the Diurnal tribe of Rapacious birds, viz. the *Accipitrine*. The *Vulturine* is the other family.

Mr. Vigors, in his paper 'On the Natural Affinities that connect the Orders and Families of Birds,' (1823), after observing that there are three important groups in the order *Raptores*, viz. the families of *Vulturidæ*, *Falconidæ*, and *Strigidæ*, corresponding with the Linnæan genera *Vultur*, *Falco*, and *Strix*, goes on to state that there may perhaps be added a fourth group, the *Gypogeranus* of Illiger, which, he observes, though it has sometimes been disposed in a different order, is now generally admitted to be a bird of prey. After reasoning upon the structure of the bird, Mr. Vigors states that he conceives it may be arranged next the *Vultures*, to which family it bears a nearer affinity than to the *Falconidæ*, in its naked cheeks and the looseness of the plumage about the head. 'The construction of the feet

also,' says Mr. Vigors in continuation, 'brings it more close to the *Vultures*, while the comparative straightness and bluntness of its toes distinguish them from the hooked and pointed talons of the *Falcons*. The greater development of the membrane which connects the toes affords an additional reason for placing it near the *Vulturidæ*. Its natural situation therefore appears to be immediately preceding this family, from which indeed it seems only to deviate in the length of its *tarsi* and its reptile food.' (*Linn. Trans.*, vol. xiv.)

M. Lesson makes the third and last family of his Diurnal birds of prey consist of *Gypogeranus*: the first consists of the *Vulturidæ*, and the second of the *Falconidæ*.

Mr. Swainson's views in considering the Secretary to be the third and last type of the family *Vulturidæ* are noticed in part in the article DODO (vol. ix., pp. 54-55), and we refer the reader to that article and to the work itself (*Classification of Birds*, vol. i., p. 285, 1836) for his reasoning on the subject, merely remarking that he there comes to the conclusion that *Gypogeranus* is evidently a compound both in structure and habits of the vulture and the falcon, and that he can incur no risk in placing it as the most aberrant of the former, seeing that, without any reference to his theoretical opinions on the subject, such an intervening station has been assigned to it by all the most eminent writers. In the 'Synopsis' (*Classification of Birds*, vol. ii., part 4, 1837), he places *Gypogeranus* among the *Aquilinæ*, his first subfamily of the *Falconidæ*.

Mr. Ogilby, at a meeting of the Zoological Society of London (July, 1835), observed that a *Secretary* (Gypogeranus) in Mr. Rendall's collection offered some peculiarities when compared with the common Cape animal, which at first induced Mr. Ogilby to believe that it might be a distinct species, and in this opinion he was in some degree confirmed by Mr. Gould; but he stated that a more attentive comparison of specimens from both localities (Mr. Rendall's having been sent from the Gambia), had considerably shaken his original opinion. Mr. Ogilby remarked however that still greater differences are indicated by Sonnerat in his figure and description of the Secretary of the Philippine Islands, and which, as far as the former was aware, had not been noticed by more recent naturalists. Whether or not the Secretaries of these three localities, the Cape of Good Hope, the Gambia, and the Philippines, may eventually turn out to be really distinct, or only varieties of the same species, must, he further remarked, be left for future observation; but, as it would be at least useful to direct the attention of travellers, collectors, and zoologists to the subject, he stated the principal marks which appeared to distinguish each, giving them provisionally specific names derived from the localities which they respectively inhabit, as follows:—

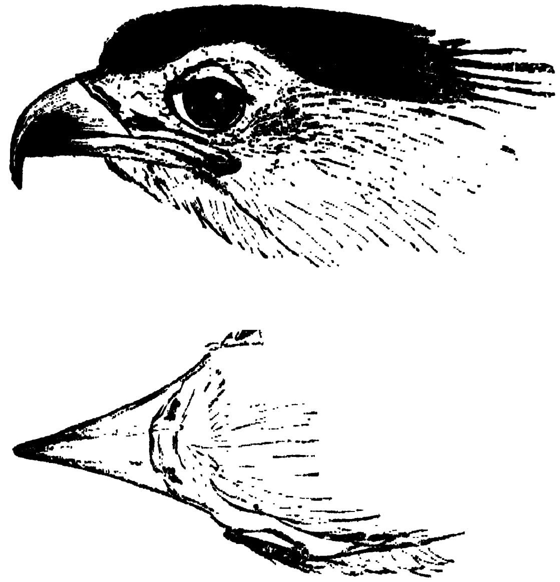
1. *Gypogeranus Capensis*, with the plume of long cervical feathers commencing upon the *occiput*, spreading irregularly over the upper part of the neck, narrow throughout the greater part of their length, as if the beard had been cut on each side close into the shaft of the quill, and spreading only at the point. Inhabits the Cape of Good Hope.

2. *Gyp. Gambiensis*, with the cervical crest commencing some distance below the *occiput*, arranged in two regular series, one on each side of the neck, with the intermediate space clear, and composed of long spatule-shaped feathers, much broader throughout than in the last species, though similarly decreasing in width towards the root. In both these species the two middle feathers of the tail are considerably longer than the others. Inhabits Senegambia.

3. *Gyp. Philippensis*, with the cervical crest spread irregularly from the *occiput* to the bottom of the neck, the longest feathers being those situated the lowest, which is just the reverse of what is observed in *Gyp. Gambiensis*, and with the two exterior tail-feathers the longest, so that the tail appears forked. This is apparent not only in Sonnerat's figure, but is expressly mentioned in his detailed description, and, if confirmed by future observation, is clearly indicative of a specific distinction. Inhabits the Philippine Islands. Described and figured in Sonnerat's 'Voyage à la Nouvelle Guinée,' p. 87, t. 50.

The colours of the three species or varieties here indicated do not, says Mr. Ogilby, in conclusion, seem to be materially different in other respects.

Sonnerat commences his description by saying that the Secretary is not only found in the Philippines, but that it also inhabits Africa, and is known at the Cape of Good Hope. He speaks of the bird as being of the size of a Turkey (Coq d'Inde), and as having the bill and feet of the Gallinaceous birds, but notices that the legs are denuded of feathers to just above the knee. Of the accuracy of the description, as far as the alleged Gallinaceous bill and feet are concerned, the student will have an opportunity of judging from the African specimens in our museums, and the living bird in the menagerie of the Zoological Society of London at the Regent's Park. But travellers and collectors will do well to bear Mr. Ogilby's provisional distinctions in mind; for the form, as we have seen, is so interesting to zoologists, that every modification of it must be considered of value. Speaking of the manners of the bird described in the 'Voyage à la Nouvelle Guinée,' Sonnerat says that it is sociable and lives in a state of domesticity; that it hunts rats, and might, in this point of view, become useful in the colonies, where probably it would not be difficult to multiply it. Although he describes the bill and feet of the Secretary as being those of the Gallinaceous birds, he states that it feeds on flesh, and ought consequently to be placed in the ranks of the Birds of Prey, among which, he adds, it forms an entirely insulated genus.



Bill of Secretary Bird.

Gypogeranus is, as M. Lesson has stated, and as appears by its skeleton, a true Bird of Prey, with long legs: the number of the cervical vertebræ, an important feature according to the views of some zoologists,* is thirteen, the atlas included. It is difficult to draw the line between the dorsal and cervical vertebræ in birds; but in two skeletons of the Secretary in the museum of the Royal College of Surgeons (No. 1207 and No. 1207*a*), there are nineteen vertebræ, counting from the ilium to the cranium, and of these thirteen may be considered cervical, because in them the costal processes are anchylosed.

Generic Character.—*Bill* rather slender, shorter than the head, strong, very much hooked, curved nearly from its origin, and furnished with a cere at its base, rather vaulted, compressed at the point; *nostrils* placed at a small distance from the base, lateral, pierced in the cere, diagonal, oblong, open. *Feet* very long, slender, the tibia feathered, but not quite to what is called (improperly) the knee behind, whilst the feathers come a very little below the joint before; tarsus long, more slender below than in its upper part; *toes* short, warty below, the anterior toes united at the base by a membrane; hind toe articulated upon the tarsus. *Wings* long, armed with obtuse spurs; the five first *quills* the longest and nearly equal.

M. Lesson says that a single species (African) (*Falco Serpentarius*, Gmel.) composes this genus, and that attempts have been made to introduce the breed into the French sugar islands (Martinique, &c.), in the hope that it might diminish the race of the formidable *Trigonocephalus*, the Yellow Serpent of the Antilles (*Trigonocephalus lanceola-*

* See Mr. W. S. MacLeay's learned and interesting paper 'On the Comparative Anatomy of certain Birds of Cuba,' *Linn. Trans.*, vol. xvi., where he remarks that the numbers of the cervical vertebræ in two very remarkable genera, *Gypogeranus* and *Tachypetes*, are unfortunately not known.

tus, Opp.), the most dangerous reptile of those parts, six or seven feet in length, and rivalling the Rattlesnake in the intensity of its poison.

Serpentarius (The Secretary).

Description.—Size, about three feet in length. Eye full, surrounded by a naked skin, with a series of hairs beneath the overshadowing feathers in the form of an eyebrow; eyelashes long and strong. Plumage, when perfect, for the most part bluish-grey, with a reddish-brown tinge on the wings; greater quills black. Throat and breast nearly white; rest of the under surface black, reddish, and white intermingled, the plumage of the legs bright black, with a slight intermixture of brownish rays. Occipital crest, which can be raised or depressed at pleasure, consisting of feathers without barbs at the base, but spreading out as they advance, and coloured of a mixed black and grey. Two middle tail feathers longest.

The Secretaries live in pairs, and do not collect in flocks: they build on high trees; but if these are not to be had, in very close thickets. They run with considerable swiftness, and are approached with difficulty by the sportsman. [CARIAMA, vol. vi., p. 292.]

GYPS. [VULTURIDÆ.]

GYPSIES. [GIPSIES.]

GYPSUM, or sulphate of lime, is a mineral which is found in a compact and crystallized state, as alabaster [ALABASTER] and selenite, or in the form of a soft chalky stone, which in a very moderate heat gives out its water of crystallization, and become a very fine white powder extensively used under the name of plaster of Paris. This last is the most common, and is found in great masses, near Paris, where it forms the hill of Montmartre, near Aix in Provence, and near Burgos in Spain. It is found in smaller portions in various parts of Europe.

The frequent occurrence of gypsum in the red clays of England and other parts of Europe, with or without salt (chloride of sodium), is an interesting fact for the geologist. Sometimes in detached nodules of fibrous structure, at other times in thin horizontal laminæ equally fibrous, and occasionally in masses which ramify into vertical, oblique, and contorted plates, with fibres perpendicular to the surface, and meeting or leaving a cavity in the middle, the gypseous masses in the red-marl of Cheshire, Somerset, Aust Passage, or Trent Fall, suggest but do not prove the truth of a notion that they are segregations from a mingled mass of muddy sediment.

The selenitic forms of sulphate of lime occur more generally in clays of every age, but especially in the oolitic formations, and are produced at this day, commonly, among diluvial clays, as in Scarborough Cliff.

For the chemical composition of gypsum, see CALCIUM, vol. vi., p. 142.

Agricultural Uses.—Gypsum generally contains a portion of silica and alumina as well as of lime, and it is to this combination chiefly that it owes its peculiar plastic qualities: pulverized by grinding or burning, it forms a peculiar species of manure, of which the effects are striking in some cases, and altogether imperceptible in others. Its use as a manure was very partially known, until Mayer, a clergyman of Kupferzell, in the principality of Hohenlohe, in Germany, noticed it about the middle of the last century, in a correspondence with Count Von der Schulenberg, at Hehlen in the electorate of Hanover, as having been long in use in the neighbourhood of Göttingen, as a top-dressing for young clover. Tscheffeli, the zealous Swiss agriculturist, soon after tried experiments with it; and his success introduced it very generally into Switzerland, where it continues to maintain its first reputation. It soon spread amongst all experimental agriculturists on the Continent; and it is generally considered as a proof of good farming when no reasonable expense is spared to procure gypsum or the Dutch peat-ashes, which are found, on analysis, to contain sulphate of lime. In England the result of experiments with gypsum has not always been so favourable, and the use of this manure has not been so generally adopted. In some instances the benefit was evident, in others not even perceptible. The doubt thus thrown on its efficacy has caused it to be neglected. In our opinion, the condemnation of it is not founded on solid grounds. It is allowed that in cold wet soils its effects, as also that of bones, are not very encouraging, nor on very poor soils; but on good loams containing a due proportion of humus, and on all light and dry soils which are not very poor, or have had a due portion of manure, its effects are striking. We have ourselves experienced the benefit of gypsum, not only on clover, but on peas, tares, and beans, where the soil was in good heart and well drained. The portions of a field sown with gypsum were decidedly superior in vigour and luxuriance of growth to those where it had not been used. So far we can bear testimony to its use.

It has been found extremely efficacious in some soils of North America. Benjamin Franklin is said to have been one of the first to try its fertilizing power on clover. He sowed it in a clover-field near one of the high roads in Pennsylvania, so as to form the letters of a sentence such as the following: 'This is manured with gypsum;' and the effect was such, that the letters could be readily distinguished by the height and colour of the clover, where the gypsum had been sown. This naturally drew the attention of all those who passed along; and no better method could have been adopted of spreading its fame. From that time gypsum has been regularly imported into America for manure from Hâvre, to which port it is brought by the Seine from Paris.

Although the exact manner in which gypsum acts in increasing the vigour of certain plants is not yet clearly shown, we know by experience that it is generally beneficial in porportion to the quantity of humus in the soil· that it is of little use where the land is wet and not well drained; and that its effects are most conspicuous in light loams, gravels, and sands, provided they be not too poor. It has little effect in promoting the growth of wheat, oats, and barley; but all plants with broad leaves are benefited in proportion as the dust lodges on the leaves. In a case where the wind had carried the powdered gypsum over part of a hedge of whitethorn, it showed its effects by making that part much richer in foliage than the rest. From this circumstance it has been recommended to be sown in moist still weather, late in the evening, or early in the morning, that the dew may make it adhere to the leaves. The heat of the sun drying the leaves would prevent this; heavy showers will also wash it off; and therefore a showery time should be avoided. A gloomy hazy day is the most favourable.

The plants on which the gypsum produces the greatest effects are those of the papilionaceous order, such as clover, peas, beans, vetches, saintfoin, and lucern. It is also useful to those of the cruciform order, as colza, rape, and mustard, and probably turnips, although it has seldom been tried on these; we have found it produce a visible improve-

ment in beans in a heavy loam, and on vetches in a lighter soil, but in both cases the land had been well manured and was in good heart. We would by no means recommend it as a substitute for dung, but as an assistant to it; considering it as a stimulant, as wine is in the digestion of our food. In both cases an excess may do harm.

There are two modes of pulverizing gypsum: by burning it to dissipate the water of crystallization; and by grinding it in a mill, or pounding and sifting it. The last method, if done sufficiently, seems the best: for the burned gypsum, or plaster of Paris, attracts moisture so rapidly, and consolidates so soon, that the first shower converts the fine dust into lumps of hard stone, thus destroying its effect on the leaves; whereas the pounded gypsum does not set so readily, and remains in a fine powder. It is also more soluble in water than that which has been burnt; although water dissolves only a very small proportion of it before it is saturated. Gypsum is the substance which gives water the quality called hardness, which prevents its dissolving soap. The gypsum is deposited by boiling the water, and adheres to the sides of the kettle. Hence it is probable that where the water is naturally hard, gypsum may have little effect on the soil as a manure.

Gypsum has a septic quality, that is, it promotes putrefaction in animal and vegetable substances. It may therefore be a very useful ingredient in composts of which the principal part is farmyard-dung. It should however be used sparingly, till its effects are more clearly ascertained. The Dutch peat-ashes and those from Newbury in Berkshire, which are in such repute as a top-dressing for clover, probably owe their power of accelerating the vegetation of this plant to the gypsum which they are known to contain. Dutch ashes, like gypsum, have little effect on cold clay soils, but act most powerfully in the light sands of Flanders.

This manure is well worth the attention of experimental agriculturists; and we doubt not that it will repay the trouble of making numerous and accurate experiments.

GYRATION, CENTRE OF. When a system of heavy bodies, or any system possessing weight, has a fixed axis of revolution, the centre of gyration is a point at any such distance from the axis, that the *moment of inertia* would not be altered if the whole mass were collected at that point. The moment of inertia being found by multiplying every mass by the square of its distance from the axis, the distance of the centre of gyration is found by dividing this moment of inertia by the whole mass, and extracting the square root of the quotient. As this term is now very little used, we refer to INERTIA for further information.

GYROCARPUS, a genus of plants containing few species, but these few are widely distributed; one being found in South America on the mountains of New Granada and Caracas, a second on those of the Coromandel Coast, and two others in the tropical parts of New Holland. Gyrocarpus has, in conformity to the opinion of Mr. Brown, been considered as allied to, and by some it has been placed in Lauraceæ. Blume refers it to his new order of Illigereæ. The flowers are polygamous or hermaphrodite; the perianth superior, four- to octi-fid; stamens four, opposite to divisions of perianth; anthers two-celled, with the cells opening by a valve from below upwards; drupe one-seeded, having attached to it two long membranous wings; the prolongation of two divisions of the perianth as in Dipterocarpeæ. The embryo is inverse; the cotyledons twisted spirally. The American is so closely allied to the Asiatic species, as to have been thought identical by Dr. Roxburgh. The latter grows to be a large tree with cordate leaves, which are deciduous about the end of the rainy season; after which the flowers make their appearance in the cold weather, but are shortly followed by the new leaves. The wood of this tree is whitish-coloured and very light. It is preferred whenever procurable for making the catamarans, or rafts on which the natives come off to ships through the heavy surf of the Madras coast.

GY'RODUS (γῦρος, round, ὀδούς, a tooth), a genus of fossil fishes established by Agassiz. The mouth of these fishes was armed with rows of round grinding teeth in the palate for the crushing of hard crustacea and fishes with bony scales. In very fine specimens five rows, which were placed on the os vomer in the roof of the mouth, remain in the stone, though no other part of the head is preserved; but generally the teeth are loose, and were in that state termed Bufonites by the old writers (Llwyd, &c.) on organic remains. (See Dr. Buckland's *Bridw. Treatise*, pl. xxvii.). The fishes of this genus belong to the oolitic strata.

GYROGONITES (γῦρος, round, γωνία, angle). This name was given by Lamarck to small fossil bodies found in fresh-water tertiary strata (Isle of Wight, near Paris, &c.), under the supposition that they were shells of polythalamous cephalopoda. (*Animaux sans Vertèbres*, tom. vii.) Lamarck was aware that his opinion was contested, and that some persons imagined the small globular transversely carinated gyrogonites were the seeds of an aquatic plant, but he 'could not believe it.' It was however demonstrated in the 'Geological Transactions,' vol. ii., Second Series, that they were, in truth, the fruits of Chara, a genus of plants found in many fresh-water ponds. The stem and other parts of this plant are very calcareous. We shall not enlarge further on this curious group of fossils, but refer the reader to Adolphe Brongniart, *Histoire des Végétaux Fossiles*, the article 'Characeæ,' for notices of their botanical relations, and to Mr. Lyell's interesting memoir in *Geol. Trans.*, vol. ii., New Series, for an account of the occurrence of Chara hispida, fossil in the marls of Bakie Loch, Forfarshire, as well as living in other lakes of the vicinity.

GYROIDINA. [FORAMINIFERA, vol. x., p. 348.]

INDEX TO THE LETTER G.

VOLUME XI.

H.

H is an aspirate of the guttural series, and is a faint pronunciation of the sound which in the high German alphabet is denoted by *ch*. In the earliest alphabets, as the Greek and Hebrew, the symbol whence the modern character is derived [ALPHABET, pp. 382, 383] denoted the syllable *che* or *he*. Hence the Hebrew name was *cheth* or *heth;* and the Greek probably at first *heta*, as it was afterwards *eta*. As the guttural sound disappeared in the latter language, the letter finally denoted the simple vowel $\bar{e}$. On the other hand in the Latin alphabet it was retained as the symbol of the aspirate. The English name *aitch* was probably at first *ech*, with the vowel prefixed, as in *ef*, *el*, &c. The guttural sound of *ch* is often confounded with the sibilant *ch*, as heard in *church*.

The letter *h* is liable to the following changes in different dialects:—

1. H is interchangeable with *c*. This is well seen in a comparison of the Latin and German languages [see C, 3]. To the examples there given may be added the Latin *decem* compared with the German *zehen*, and *ducere* compared with *ziehen* (*zug*).

2. H is interchangeable with *ch*. Thus the Greek forms χειμων, χειμερινος, χαινω, χορτος, χαμαι, are severally connected with the Latin *hiems*, *hibernus*, *hio*, *hortus*, *humi*.

3. H with *chth*. This is similar to the interchange of *k* with *kt*, as seen in the various forms of the Latin roots *plec* and *plect*, *nec* and *nect*. Of the interchange between the aspirates there are examples in the Greek χθες compared with the Latin root *hes*, seen in *heri* and *hesternus*, and perhaps the Greek χθον (nom. χθων) compared with the Latin *humo* (nom. *humus*).

4. H is interchangeable with *g*. Examples: the German *zehe* compared with the Latin *digito;* the German *fliehen*, *sehen*, compared with the English substantives *flight*, *sight:* and perhaps the Latin *veh-mens*, the first element of which is identical with the German prefix *weg*, a derivation which will make *vehemens* equivalent to *amens* or *demens*.

5. H with *s*. Compare the Latin *sub*, *sex*, *septem*, *sus*, *salio*, with the Greek ὑπο, ἑξ, ἑπτα, ὑς, ἁλλομαι, &c. Thus the antient Spanish town Hermandica, mentioned by Livy in his 21st book, is proved by the Greek form Helmantice to be identical with Salmantica, the antient name of Salamanca.

6. H with *f*. Hence the Latin words *hostis*, *hostia*, says Festus, were sometimes written *fostis*, *fostia*. So too the French word *hors*, well known in the phrase *hors de combat*, is derived from the Latin *foris*. The Spanish language abounds in examples of this change, as in the names *Herdinando* and *Ferdinando;* so also *hermoso*, from the Latin *formoso;* the Portuguese retains the form *formoso*.

7. H with *w*. Many Greek words which had originally the digamma (another name for the letter *w*) at the begining, took a mere aspirate afterwards. So in our own language the word *who* has nearly exchanged the *w* for what is sounded as an *h;* and the relative adverb *how* is no doubt derived from the relative itself. It is in this way that the Latin *homo* is *uomo* in Italian and *uhôm* in Walachian.

8. When any consonant or consonants in the middle of words had nearly lost all sound, the letter *h* appears to have been employed as a fit representative of the vanishing sound. Hence in Latin *mihi*, for what would appear by analogy to have been once *mibi;* and in German *stehen* and *gehen*, for what must originally have been *standen* and *gangen*.

9. The letter *h* is often dropped altogether in pronunciation, and hence in writing also. This was perhaps the reason why the Greeks gave up the letter *h* for the little mark called the *spiritus asper*. In Latin many words are written indifferently, with or without an *h*, as *arena*, *harena;* *arundo*, *harundo;* *onustus*, *honustus*. Thus the last words show that *hon-or* and *hon-us* (*onus*), *honestus* and *honustus*, are all of the same origin, being derived from a root *hon*, denoting a *load* or *charge*, which is either an *honor* or a *burden*, according to the nature of the case. The Italians for the most part, like the inhabitants of antient Rome, are averse to all aspirates; the people of Tuscany, on the other hand, still maintain their antient character for the strongest pronunciation of these harsh sounds.

HAARLEM, HAERLEM, or HARLEM, is a large city in the province of North Holland, in the kingdom of the Netherlands, on the navigable river Spaaren, which runs from the Lake of Haarlem into the Y, by which it has a communication with the Zuydersee, and, by means of navigable canals, with Amsterdam, Leyden, and the Lake of Haarlem. It is fortified in the old style, and was formerly considered a place of great strength. It was a flourishing town in the middle of the twelfth century, and acted an important part in the wars between the Dutch and the West Frieslanders. In 1492 it was taken by the revolted peasants of North Holland; but the Imperial governor, Albert, duke of Saxony, recovered it in the same year, deprived it of all its privileges, and imposed heavy contributions. In the revolt of the Netherlands in the sixteenth century, it joined the allies in 1572; it was in consequence besieged by the Spaniards, but after an obstinate resistance of nearly eight months it was obliged to surrender to Frederick, son of the duke of Alba, who treated the inhabitants with great cruelty. In 1577 it was retaken by the prince of Orange.

The manufactories of Haarlem were formerly very flourishing, and it has still some good silk, ribbon, velvet, linen, and other manufactures; but its establishments for bleaching linen and thread, once the most celebrated in Europe, have fallen entirely into decay. The culture of flowers is still very important, though the times are long since past when 10,000 florins were given for one tulip: the great florists, now about seventeen in number, live chiefly on the south side of the town, and supply the remotest parts of Europe with flowers, especially hyacinths (even now from 25 to 100 florins are sometimes paid for a root). Haarlem attained its highest prosperity in the seventeenth century, but it gradually declined, and in recent times suffered severely from the French revolution and its subjection to France. The decrease of the population bears melancholy testimony to this decay: in 1740 it was still 40,000 souls, was reduced in 1785 to 30,000, and in 1819 to 18,000: in 1837 it had increased to about 22,000, and on the whole the town appears to be recovering. Though not equal to Leyden and some other towns in Holland, its streets are remarkably clean, planted with trees, and traversed by numerous canals. Among the public buildings the most remarkable are the town-hall, a handsome building, with a valuable collection of pictures; the palace, or Prinzenhof, and some of the churches, especially the cathedral, the largest church in Holland, in which is the celebrated organ, one of the largest and most perfect instruments in the world, containing 8000 pipes, some of which are 38 feet high and 5 feet in diameter (it has 60 stops). Haarlem, besides many other useful and charitable institutions, has an academy of sciences, a botanic garden, a public library, and Teyler's institution, which comprehends an establishment for the poor, a society of natural history, valuable collections, and an observatory. The library boasts of the early productions of Laurence Coster, a native of this town, to whom the Dutch attribute the invention of the art of printing in 1424, and have placed his statue in marble in the market-place. In 1824 the fourth centenary of his supposed invention was celebrated with great ceremony, and a monument erected in his honour in the Haarlem Bosch, a most delightful grove near the town, remarkable for the great height and beauty of the trees, and in which there are numerous country-houses with fine gardens, the most distinguished of which is that of Welgelegen, the splendid seat of M. Hope, the banker. The Lake of Haarlem is about fourteen English miles in its greatest length, and nearly as many in breadth, but only six feet deep. It has been frequently proposed to drain this lake, and to cultivate the many thousand acres of land which it covers. As the overflowing has often occasioned much injury, the idea of draining appears to have been generally entertained, but no plan yet offered has been approved; and a bill introduced by the government in the present session (April, 1838) was rejected almost unanimously in the Second Chamber of the States-General.

HAARLINGEN. [FRIESLAND.]

HABAKKUK (חֲבַקּוּק, 'Αμβακοὺμ, 'Αββακούμ, 'Αββακούκ), one of the twelve minor Hebrew prophets. We

have no particulars respecting the place and time of his birth; but it appears probable that he prophesied in the beginning of the reign of Jehoiakim (B.C. 609). It is evident from the prophecy that Jerusalem had not yet been taken by the Chaldæans; but that Judæa had been overrun by their armies. We learn from 2 Kings, xxiv. 1, that the Chaldæans under Nebuchadnezzar made Jehoiakim tributary to them at the beginning of his reign; but Jerusalem was not taken till the reign of his successor Jehoiachin. Clement of Alexandria (*Strom.*, i. 142) places Habakkuk in the reign of Zedekiah; which agrees with the account in the Apocryphal story of Bel and the Dragon, according to which Habakkuk lived in the time of the Babylonish captivity.

The prophecy of Habakkuk may be divided into two parts. The first is in the form of a dialogue between God and the prophet: the prophet begins by deploring the desolate condition of Jerusalem (i. 1—4); God is then introduced fortelling the destruction of the Jewish state by the Chaldæans (i. 5—11); the prophet replies by expressing a hope that the Jews may not be entirely destroyed, and that the Chaldæans may be punished, since they are as wicked as the Jews (i. 12—17; ii. 1); God assures the prophet that the captivity of the Jews will only last for an appointed time, and that the Chaldæans would eventually be punished on account of their iniquities (ii. 2—20). The second part is a prayer or psalm, in which the prophet recounts the wonderful works God had wrought on behalf of his people in past times, and prays unto Him to preserve the Jews in their captivity, and 'in wrath to remember mercy' (c. iii.).

The prophecy of Habakkuk is written in an energetic style, and contains many beautiful passages. The third chapter is considered by Bishop Lowth as one of the finest specimens we possess of the Hebrew ode.

The canonical authority of the book has never been disputed. It is quoted in the New Testament: compare Hab. ii. 4, with Rom. i. 17, Gal. iii. 11, Hebr. x. 38; and Hab. i. 5, with Acts xiii. 40, 41. Many divines consider the passage ii. 2—4 to be a prophecy relating to the Messiah, implying also the deliverance of the Jews by Cyrus. But till the scheme of secondary prophecies (that is, of making the same prophecy fulfilled by two distinct and different events) is better established, we must withhold our assent to such an hypothesis.

(Horst, *Die Visionen Habakuk's*, Gotha, 1798; Justi, *Habakuk neue übersetzung*, &c., Leip. 1821; Ranitz, *Introductio in Habacuci Vaticinia*, Leip. 1808; Friedrich, *Historisch kritischer versuch über Habakuk's Zeitalter*, in Eichhorn's *Bibliothek der Bibl. Litt.*, x. 379—424; Eichhorn, *Einleitung in das Alte Testament*, iv. 399—414; Rosenmüller, *Scholia*; and the list of commentators in Watt's *Bibliotheca Britannica*.)

HABEAS CO'RPORA JURATO'RUM, a judicial writ for the purpose of enforcing the attendance of jurors. [JURY.]

HA'BEAS CORPUS is a writ at the common law, used for various purposes. When the writ of Habeas Corpus is spoken of without further explanation, it always implies the important writ which will presently be described; but it is also used for certain formal purposes in the courts of common law at Westminster for removing prisoners from one court into another, and for compelling the attendance of prisoners as witnesses, &c. But the great writ of Habeas Corpus is that which in cases of alleged illegal confinement is directed to the person who detains another; and the purport of the writ is a command to such person to produce the body of the prisoner, and to state the day and the cause of his caption and detention, and, further, to submit to and receive whatsoever the judge or court awarding the writ shall direct.

The old writ *de homine replegiando* was issued for the purpose of replevying a man out of custody in the same manner as chattels taken in distress may be replevied [REPLEVIN] upon giving security to the sheriff that the man should be forthcoming to answer any charge against him. And if the prisoner was removed out of the sheriff's jurisdiction the sheriff might make his return accordingly, and thereupon a process issued (called a *capias in withernam*) to imprison the party withholding the prisoner until he was produced. From the many exceptions however with which this writ was guarded, especially in causes where the crown was concerned, it was a very insufficient remedy. The decision of the judges of the King's Bench in the early part of the reign of Charles I., that they could not, upon a Habeas Corpus, bail or deliver a prisoner, though committed without any cause assigned, in cases where he was committed by the special command of the king, or by the Lords of the Privy Council, caused the parliamentary inquiry which was followed by the Petition of Right, which recites this judgment and enacts that no freeman shall be so imprisoned or detained. The court however and the judges still endeavoured to uphold the prerogative of the crown, and consequently the statute 16 Car. I., c. 10, was extorted by the parliament, which enacted that any person committed by the king himself or his Privy Council, or any members thereof, should have the writ of Habeas Corpus granted to him upon demand or motion made to the Court of King's Bench or Common Pleas, which should thereupon, within three court days after the return of the writ, examine and determine the legality of the commitment, and do justice in delivering, bailing, or remanding the prisoner. Still however new shifts and devices were made use of to prevent the due execution of this enactment, and eventually the statute 31 Chas. II., c. 2, was passed, which is called the Habeas Corpus Act, and is frequently spoken of as another Magna Charta. By this statute the methods of obtaining this writ are plainly pointed out, and so long as it remains in force no English subject can be long detained in prison, except in those cases where the law requires and justifies a detainer. And lest this statute should be evaded by demanding unreasonable bail or sureties for the prisoner's appearance, it is declared by the 1 W. and M., stat. ii., c. 2, that excessive bail shall not be required. (Bl. *Com.*, vols. i. and iii.)

It has been customary in times of alleged danger to suspend the Habeas Corpus Act; but these are in fact the very times when the statute is most necessary. The Habeas Corpus is the protection only of the innocent, not the defence of the guilty. A suspension of the Habeas Corpus Act is effected by an act of parliament authorising the crown, for a limited period, to imprison suspected persons without giving any reason for so doing. But it has been customary to pass acts of indemnity subsequently, for the protection of those who have acted under the suspension. An instance of the one is afforded by the 57 Geo. III., c. 3, and of the other by the 58 Geo. III., c. 6. (Bl. *Com.*, Coke, 2, *Inst.*)

The Statute 31 Chas. II. has been re-enacted or adopted, if not in terms yet in substance, in most of the American States, and the New York revised statutes (vol. ii., p. 561) provide for relief under the writ *de homine replegiando*, in favour of fugitives from service in any other state, but this provision has been held to be contrary to the constitution and laws of the United States, and void in respect to slaves being fugitives from states where slavery is lawful. (Kent's *Com.*)

HABE'RE FA'CIAS POSSESSIO'NEM, a judicial writ directed to the sheriff, commanding him to put the recoveror of a chattel interest in lands into possession. It answers to the *Habere facias seisinam*, where the freehold is recovered. [EXECUTION.]

HABE'RE FA'CIAS SEISI'NAM, a judicial writ directed to the sheriff, commanding him to put the recoveror of a freehold interest in lands into actual possession. In the execution of this writ, as well as of the writ of *Habere facias possessionem*, the sheriff may justify breaking open doors if the possession be not quietly delivered. The execution is effected by the delivery of a twig, or a clod, &c., of land; or by the delivery of the key of the door, &c., if a house is the subject matter of which the sheriff is directed to put the recoveror in possession,—all other persons being first removed from the premises. But if it be the presentation to a benefice which is recovered, the execution is by writ *de clerico admittendo*, directed, not to the sheriff, but to the bishop or archbishop, directing him to admit and institute the clerk of the recoveror. [EXECUTION.]

HABSBURG, THE HOUSE OF, was the original title of the House of Austria. Rudolf, the founder of the Austrian dynasty, was born in 1218, and was the son of Albert, count of Habsburg in Aargau, and of Hedwige of Kyburg, who was descended through her mother from the once powerful House of Zäringen. In his youth he was engaged in frequent warfare with the neighbouring barons, and with the banditti who infested his own or the neighbouring territories, and afterwards he served under Ottocar, king of Bohemia, against the Prussians and the Hungarians. In 1264 Rudolf succeeded to the rich inheritance of his uncle, Hartmann the Elder, count of Kyburg, which included the

greater part of the Aargau, and portions of the present cantons of Bern, Lucern, Zürich, and Zug, besides the advocacy or protectorship of the Waldstätter, or forest cantons. By this inheritance Rudolf, whose domains were at first very limited, became lord of considerable territory, though he was by no means equal to the great electoral princes of Germany. But he found a powerful friend in Werner, archbishop of Mainz, who was so pleased with the abilities, the wisdom, and justice which Rudolf displayed in the administration of his enlarged territories, that he cast his eyes upon him as a fit occupant of the Imperial throne. The archbishop sounded the other electors, and won them all over to his views, except Ottocar, king of Bohemia, whose ambassadors protested, though in vain, against Rudolf's election, which took place at Frankfurt in 1273. Rudolf was then besieging Basel, the burghers of which city had killed some of his relatives in an affray. On the news of his elevation the people of Basel were the first to hail him as the head of the empire and to swear allegiance to him, and Rudolf hastened to Aix-la-Chapelle, where he was crowned King of the Romans by his friend the archbishop of Mainz. The next thing was to have his election acknowledged by the papal see. Fortunately for him, Gregory X., then pope, was a man of a moderate disposition and conciliatory temper, and he willingly acknowledged Rudolf as head of the Western empire, while Rudolf on his part made several timely concessions: he renounced all jurisdiction over Rome, all feudal superiority over the marches of Ancona and the duchy of Spoleto, all interference in ecclesiastical elections, and, excepting the right of temporal investiture of newly elected bishops, which he retained, he acknowledged the independence of the Germanic church on the crown. This was a happy termination of the quarrel of two centuries' duration between the church and the empire. Rudolf turned next to Ottocar, king of Bohemia, who refused allegiance to him. Ottocar, besides Bohemia, had taken possession of Moravia, Austria, Styria, Carinthia, in short, of the greatest part of the present Austrian empire. Rudolf laid siege to Vienna, and crossing the Danube on a bridge of boats, defeated Ottocar, who sued for and obtained peace by giving up Austria, Styria, Carinthia, and Carniola. Rudolf confirmed him in the possession of Bohemia and Moravia. Rudolf appointed his two surviving sons, Albert and Rudolf, joint-dukes of Austria and Styria, giving Carinthia to Meinhard, count of the Tyrol, whose daughter had married his son Albert, but stipulating for the right of reversion to his own family in the event of the extinction of Meinhard's male posterity. Ottocar having soon after revolted, was again defeated and killed in battle, and his son Wenceslaus, who had married a daughter of Rudolf, succeeded him as king of Bohemia, and continued the peaceful liege of his father-in-law. But the greatest merit of Rudolf is that of having restored order and tranquillity in the internal administration of Germany. In successive diets he compelled or persuaded the princes to submit their differences to arbitration, to swear to the observance of the public peace, and to consent to the demolition of the fortresses which had been erected by the nobles for plunder as well as for war. In one year he razed seventy of these mischievous strongholds, and he condemned to death no fewer than twenty-nine nobles of Thuringia, who still presumed to disturb the public peace. Rudolf granted a number of charters to many towns and rising municipalities. His reign exhibited a remarkable novelty for Germany—internal tranquillity. His probity became proverbial, and his sincere respect for religion is attested by many facts. He forgot personal wrongs, and gratefully rewarded personal services, especially in those who had rendered him assistance in his early life. He was accessible to the humblest of his people. 'He has been truly called the second restorer of the empire; none of his predecessors, excepting Charlemagne, ever procured such benefits for it. That he who rose from the condition of an humble territorial count to that of a great emperor must have been an extraordinary man, cannot be disputed. If he owed much to his good fortune, he was still more indebted to his own merit. Accident might have introduced him to the archbishop of Mainz, but accident could not have won the admiration and esteem of that prelate. Well may the House of Austria, indisputably the noblest in Europe, glory in its founder.' (Dunham, *History of the Germanic Empire.*)

Rudolf I. died in 1291, in a good old age, leaving only one surviving son, Albert, besides several daughters. His other son, Rudolf, died before his father, leaving one son, John, under Albert's guardianship. Albert I., duke of Austria, was elected emperor in 1298, and was murdered at Windisch, in Aargau, by his nephew John, to whom he would not give up his paternal inheritance. [ALBERT I.] He left a numerous progeny. His eldest son, Rudolf, married the widow of Wenceslaus, and succeeded to the crown of Bohemia in 1306, but died shortly after. Albert's second son, Frederick the Handsome, duke of Austria, died in 1330, without issue. His brother Leopold, who shared with Frederick the administration of the Austrian dominions, marched against the Swiss, and was defeated by them at the battle of Morgarten, 15th November, 1313. He died in 1326. Albert's fourth son, Albert II., called the Wise, succeeded his brother Frederick as duke of Austria and of Styria, and died in 1358, leaving a numerous family. His eldest son, Rudolf III., duke of Austria, became, in 1363, count of Tyrol and Carinthia by the extinction of Meinhard's male posterity, and died in 1365. He was succeeded by his brother Albert III. jointly with his other brother, who is styled Leopold II., and who fought against the Swiss, and was defeated and killed at the battle of Sempach, 9th July, 1386. Albert himself died in 1395, leaving his dominions divided between his two sons: the elder, Albert IV., became duke of Austria, and the other, Leopold, duke of Styria and Carinthia. Albert IV. died in 1404, and was succeeded by his son Albert V. of Austria, who married Elizabeth, daughter of the Emperor Sigismund, whom he succeeded as king of Hungary and Bohemia in 1437, and in the following year was elected emperor by the name of Albert II. of Germany. He died in 1439, in a village of Hungary, while defending that country against Amurath II., sultan of the Ottomans. His posthumous son Ladislaus succeeded to the titles of duke of Austria and king of Hungary and Bohemia, under the guardianship of his cousin Frederick, duke of Styria. The Hungarians however would not acknowledge the infant Ladislaus, and offered the crown to another Ladislaus, king of Poland, who was shortly after killed at the battle of Varna against the Turks, A.D. 1444. The Hungarians then chose as their regent John Hunniades, under a nominal allegiance to Ladislaus the Posthumous. The Bohemians refused to acknowledge Ladislaus, and chose Podiebrad as their leader. In 1451 however Ladislaus was acknowledged king of Bohemia, Podiebrad submitted to him, and was confirmed in his authority. Ladislaus was but a nominal king, and he died at Prague in 1458, leaving his cousin Frederick of Styria, who had been elected emperor by the name of Frederick III., heir to his numerous titles. The reign of Frederick, which lasted more than half a century, was inglorious to himself and disastrous to his subjects. [FREDERICK III. OF GERMANY.] Matthias Corvinus, the son of Hunniades, seized upon the crown of Hungary, and Podiebrad upon that of Bohemia, and after their death both crowns were united on the head of Ladislaus, son of Casimir, king of Poland. Of his hereditary states of Austria Frederick was obliged to resign a part to his own brother Albert. Frederick however was successful in marrying his son Maximilian to Mary, daughter of Charles the Rash, and heiress to the vast dominions of the ducal House of Burgundy, by which means Franche Comté, Alsace, the Netherlands, Artois, in short, all her father's territories, with the exception of Burgundy Proper, which was annexed to France, were united to the estates of the House of Austria. It was on the occasion of this marriage, A.D. 1477, that Frederick bestowed on his son Maximilian the title of Archduke of Austria, which his successors have born ever since. Frederick died in 1493, and Maximilian succeeded him in the Austrian dominions as well as on the Imperial throne, having been elected King of the Romans in his father's lifetime. Indeed, from this time down to the dissolution of the German empire in our own days the Imperial dignity may be said to have become hereditary in the House of Austria. The reign of Maximilian was an important one both to Germany and to the Austrian dominions. He consolidated both the power of his house and that of the empire. He was the reformer of the public law of Germany, and the creator of German military discipline, being the first to establish a standing army, with infantry, cavalry, and artillery, divided into regiments and subdivided into companies. He secured the reversion of Hungary and Bohemia to his posterity by a double marriage of the Archduchess Maria, his grand-

daughter, with Ludovic, son of Ladislaus, and of Anna, sister of Ludovic, with his grandson Ferdinand. His own son Philip was married to Joanna, heiress of Castile and of Aragon. Maximilian died in 1519, and was succeeded on the Imperial throne by his grandson Charles V., who, in 1521, renounced the hereditary dominions of Austria to his younger brother Ferdinand, who afterwards, by the death of his brother-in-law Ludovic, king of Hungary and Bohemia, who fell in 1526 in the battle of Mohacz against the Turks, was acknowledged king of Bohemia. The Hungarians however, refusing to acknowledge Ferdinand's claims, raised to the throne John Zapoli, palatine of Transylvania, and after his death his son John Sigismund. This led to a long war, in which the Turks took a part, and which lasted the whole life of Ferdinand. By the abdication of his brother Charles V., Ferdinand was raised to the Imperial throne, with the sanction of the Imperial Diet, in 1558. [FERDINAND I. OF AUSTRIA.] From this time the House of Austria was divided into two great branches, the successors of Charles V., or the Spanish branch, and those of Ferdinand, or the German branch. Ferdinand I. died in 1564, leaving his eldest son, Maximilian, as archduke of Austria, and his other son, Charles, as duke of Styria, Carinthia, and Carniola. Maximilian succeeded his father as emperor, and died in 1576, after an able and wise reign. He concluded a convention with John Sigismund, who resigned to him the crown of Hungary, retaining the title of prince of Transylvania. In Bohemia Maximilian was acknowledged without difficulty, and his government was praised by both Catholics and Protestants for its tolerance, moderation, and respect for their local privileges and usages. He was succeeded by his son Rudolf, styled Rudolf II., emperor of Germany. For the first time since the Habsburg family came into possession of the Austrian territories, Rudolf, as Maximilian's eldest son, obtained the sole possession of his paternal dominions, while his brothers, instead of having a joint share in the government, were provided with annual pensions. This change, whether arranged during the reign of Maximilian II., or effected by a family compact between his heirs, established the right of primogeniture in the House of Austria, which has remained ever since. (Coxe, *History of the House of Austria.*)

Rudolf II. was very different from his father; he was bigoted and intolerant, and he alienated the Protestants of his dominions by forbidding the public exercise of their worship. The result was insurrection, followed by repression and persecution. The same course pursued in several of the German States led the Protestants to form a confederation, and to ally themselves with the United Provinces of Holland and with Henry IV. of France. Henry was assassinated in May, 1610, just as he was ready to pour his troops across the frontiers, and Rudolf himself died in 1612, leaving no issue. He was succeeded by his brother Matthias, who had already in his brother's lifetime seated himself on the thrones of Hungary and Bohemia, being assisted by the Protestants, whom he favoured. After a short interregnum Matthias was elected emperor. He died in 1619, also without issue, leaving his cousin Ferdinand, son of Charles, duke of Styria, and grandson of Ferdinand I., to succeed him. But before Matthias's death Bohemia was again in open insurrection, owing to the intolerant conduct of the archbishop of Prague, who had demolished several chapels of the Dissidents. This was the origin of the famous Thirty Years' War, which shook Europe to its very extremities. The events which followed are noticed in the article FERDINAND II. of Germany. [GUSTAVUS ADOLPHUS.] Ferdinand II. died in 1637, and was succeeded by his son Ferdinand III., who, being wiser and more moderate than his father, put an end to the war, in 1648, by the treaty of Münster and Osnaburg, called also the treaty of Westphalia. Ferdinand died in 1657, and was succeeded by his son Leopold, who was already king of Bohemia and Hungary. Leopold, styled I. of Germany, a man of very inferior abilities, had a long and troubled reign, continually harassed by the unprincipled ambition of Louis XIV., who, aided by some alliances which his money enabled him to procure among the German electors, became the scourge of Germany. The horrors committed by the French troops in the Palatinate are still remembered with detestation. Louis, in order to annoy Leopold still more, prevailed on the Turks to advance to the very walls of Vienna, when at last a sense of the general danger roused Holland, England, Denmark, and even Sweden against the common disturber of Europe. The victories of Eugene and Marlborough saved the empire on the side of the Rhine, as Sobieski had saved Austria on the Turkish side. Thus Leopold was enabled to weather the storm. He died in 1705, leaving his son Joseph to succeed him, while his other son, Charles, was fighting in the peninsula for the crowns of Spain and the Indies. Joseph I. reigned only a few years, but his reign was glorious; his armies and those of his allies completely turned the fortune of war against Louis XIV. He died in 1711, and was succeeded by his brother Charles, who put an end to the war of the Spanish succession by renouncing his claims to the crowns of Spain and the Indies in favour of Philip of Bourbon. The sequel of Charles's reign is given in the article CHARLES VI. of Germany.

One great object of Charles's policy was to secure his hereditary dominions to his own daughter Maria Theresa, in preference to the daughters of his elder brother Joseph, both brothers having no male offspring. For this purpose Charles issued in 1713 the Pragmatic Sanction, an ordinance which established the right of succession in his own daughter, and he obliged his nieces to confirm it by renouncing their pretensions on their respective marriages with the Electors of Bavaria and Saxony. He also obtained from the various states or provincial assemblies of his dominions the acknowledgement of the Pragmatic Sanction, and he induced most of the German and other European powers, with the exception of the Bourbons, to guarantee this family compact. Charles VI. died in 1740, and in him the male line of the House of Habsburg and Austria became extinct. His daughter Maria Theresa, who had married Francis of Lorraine, grand-duke of Tuscany, succeeded, after an arduous struggle, in securing the possession of the Austrian dominions. [FRANCIS I. of Germany.]

When Maria Theresa, who had survived her husband, died in 1780, her eldest son, Joseph, who had already succeeded his father as emperor of Germany in 1765, took into his hands the administration of the Austrian dominions. [JOSEPH II. of Germany.] Joseph died in 1790, without issue, and was succeeded by his younger brother Leopold, grand-duke of Tuscany, whose wise reign was but short. He died in 1792, leaving his youthful son Francis to stand the brunt of the political storms which had gathered over Europe in consequence of the French revolution. A sketch of the long and eventful reign that followed is given under FRANCIS II. of Germany.

Francis in 1806 resigned the title of emperor of Germany, and assumed that of Francis I., emperor of Austria. He died in 1835, leaving the crown to his eldest son, Ferdinand I. of Austria, born in 1793.

Leopold II. left a numerous family besides Francis. His second son, the archduke Charles, born in 1771, became well known in the wars with France as general-in-chief of the Austrian armies. The next, the archduke Joseph, born in 1776, became palatine and governor-general of Hungary. The archduke John, born in 1782, became known as general in the Austrian armies. The archduke Renier, born in 1783, has been made, since the peace, viceroy of the Lombardo-Venetian kingdom. Of the sisters of Leopold, the eldest, Marie Antoinette, married Louis XVI. of France; the next, Maria Carolina, married Ferdinand, king of the Two Sicilies; and another married the Duke of Parma. A younger brother of Leopold, the archduke Ferdinand, married Maria Beatrice, heiress of the house of Este, by whom he had Francis Joseph, the present Duke of Modena. (Coxe, *History of the House of Austria*; Dunham, *History of the Germanic Empire*, in Lardner's *Cyclopædia*.)

The castle of Habsburg, the manorial residence of Rudolf I., has long since ceased to belong to his posterity. While Rudolf's successors were extending their sway over both hemispheres, they lost by degrees in the wars of Switzerland all their patrimonial domains in that country. Two square towers of the castle of Habsburg still remain, standing on a steep hill on the right bank of the Aar, not far from Brugg, and opposite the baths of Schinznach; they now belong to a farmer of Aargau. The sepulchres of the Habsburg family, which were at Königsfelden, in the neighbourhood, have been removed to St. Stephen's cathedral at Vienna.

HACHETTE, JEAN NICOLAS PIERRE, was born at Mezières, May 6, 1769. He began his studies at Mezières, where Monge then held a professorship. At the age of

twenty-three he was the successful competitor in the *concours* for a professorship of hydrography at Collioure. Some memoirs on mathematical subjects which he addressed to Monge, then minister of marine, procured him to be called to Paris, from whence he was sent to fill a professorship at Mezières, and at the end of 1794 was appointed to the Ecole Polytechnique, at its establishment. In this post he continued till the accession of Louis XVIII., by whose feeble and fanatical government he had, in 1816, the honour of being deprived of his professorship, at the same time when Monge was expelled from the Institute. The government above mentioned refused to sanction his admission to the Academy of Sciences; nor was it till after the Revolution of 1830 that the fellow-labourer of Monge, the instructor of Poisson, Fresnel, Arago, and of more than two thousand of the best qualified public officers in France, was permitted to sit among his former pupils at the Palais de l'Institut. M. Hachette died in January, 1834, at the time when the cholera was raging in Paris, though not of that disorder. Independently of his public services, he obtained the respect of the whole community for his private worth: and the writer of this article, who enjoyed his acquaintance and correspondence during the last years of his life, can bear testimony to the openness, simplicity, and benevolence of his character, which, though not very common to such an extent among his countrymen, are, of all other qualities, those which most assist and least require their well-known address and manners.

The greater part of the life of M. Hachette was devoted to the development of the descriptive geometry of Monge, and its application in the arts of life, particularly in the description and construction of machinery. The attention which was paid to this subject from the opening of the Polytechnic School was one main cause of the improvement which took place in France as to all matters connected with construction. There is no question that since the Revolution of 1789 that country has made very rapid progress in all that relates to the arts which depend upon geometry. The genius of Monge and the foresight of those who founded the Polytechnic School were the primary causes of this improvement: M. Hachette was the most distinguished among those whose efforts filled up the details, disseminated the knowledge of the whole, and kept alive the impulse which the new state of things had given. Monge left the details of the descriptive geometry for the most part to Hachette, who made the first special applications, and particularly to the construction of machinery. His works on descriptive geometry (that of Monge being comparatively elementary) and on machinery are in high repute, and the former, in our opinion, still continues to be the best of those which enter as much into detail.

The works of M. Hachette are:—

'Programmes d'un Cours de Physique,' 1809; an extension of a work previously written by Monge and Hachette in 1805. 'Correspondence sur l'Ecole Polytechnique,' 1803-1815, a work edited by M. Hachette, and containing many memoirs by himself, some of great interest. 'Epures, or Collection of Drawings exemplifying the processes of Descriptive Geometry,' 1817. 'Elémens de Géométrie, à trois dimensions,' 1817, in two parts, geometrical and algebraical. This work is remarkable as containing various theorems, demonstrated geometrically, which had not been previously obtained without algebra. 'First and Second Supplements to the Descriptive Geometry of Monge,' 1812 and 1818. 'Traité Elémentaire des Machines,' first edition about 1820, and three others since published. M. Hachette had previously, in 1808, taken a share in the work of M. Lanz and Bétancour, 'Sur la Composition des Machines.' 'Géometrie Descriptive,' 1822. Various memoirs in the 'Annales d'Agriculture;' 'Société Royale, &c., d'Agriculture;' 'Société d'Encouragement,' &c.; 'Journal de L'Ecole Polytechnique,' &c. &c.

HACKET, JOHN, was born in the year 1592, and educated at Westminster School, whence he was elected to Trinity College, Cambridge, at the age of sixteen. In 1618 he took orders, and soon after became chaplain to the bishop of Lincoln. On the breaking out of the civil war he was appointed one of a sub-committee whose office it was to prepare a report on ecclesiastical reform for a commission empowered by the House of Lords. To this scheme however a stop was put by the prevalence of the troubles and the opposition made by the bishops. During the civil war he espoused the cause of Charles, and his house was a kind of rallying point for his party. His zeal however led him into difficulties, and he suffered a short imprisonment; but after the Restoration he accepted the bishopric of Lichfield and Coventry, where he died in 1670.

To Bishop Hacket we are chiefly indebted for the restoration of Lichfield cathedral. It had been cannonaded and subjected to all sorts of insult and pillage at the hands of the Puritan party; however, during the eight years that he held the bishopric, he contrived, partly at his own expense and partly by subscription, to put it into complete repair.*

HACKNEY. [MIDDLESEX.]

HADDINGTON. [HADDINGTONSHIRE.]

HADDINGTONSHIRE is one of the three counties of Scotland included under the general name of the Lothians, and is very commonly called East Lothian. It is a maritime county, bounded on the north and north-east by the German Ocean, on the north-west by the Frith of Forth, on the south-west by Edinburghshire, or Mid Lothian, and on the south-east by the Lammermuir hills, which are partly in the county of Berwick. It is comprised between 55° 46′ and 56° 5′ N. lat., and 2° 20′ and 3° 2′ W. long. The extreme length of the county from east to west is about 27 miles, and its extreme width from north to south is somewhat less than 16 miles. The area contains 174,080 statute acres, of which 139,264 are cultivated.

General Appearance.—The surface of the county is extremely diversified, though not mountainous. The principal hills are those of Lammermuir, from the summit of which the distant prospect is both rich and beautiful. The general inclination is from the foot of the Lammermuir range towards the north-east, but the descent is far from uniform. From the shore of the Frith of Forth the county consists of a series of parallel ridges running from west to east, and successively increasing in altitude until they reach the Lammermuir hills.

Soils.—In the north-western part of the county, comprising the whole of the coast-lands from Ravensheugh Craig on the east as far as Preston Pans on the west, the prevailing soil is productive, and consists of a light rich loam with a substratum of clay. In the Lammermuir, or south-eastern district, the soil is principally moor or moss, though in in the glens and flats which intersect the mountains it is of superior quality and kept under a regular rotation of crops. In the upland district, which extends along the foot of the Lammermuir hills nearly the whole length of the county, the soil is a gravelly loam resting upon a dry bottom, and its improvement, owing to its elevation, was much neglected till within the last thirty years, within which period it has been rendered comparatively productive. In the higher grounds of this district the limestone rock approaches so near the surface as to admit of but a shallow furrow. The midland district, through which the river Tyne flows, contains a considerable variety of soil; nearly the whole of which is extremely valuable and principally arable. In Haddington parish it is generally good and highly cultivated, but at Gladsmuirit is thin and of inferior quality. Upon the whole it appears that four-fifths of the soil of this county is in tillage; the remaining fifth comprises the woods, plantations, pastures, and wastes.

Climate.—The different elevations of the several districts occasion a corresponding variation in the climate, and there is probably no county in Scotland of equal extent in which the barometric changes are so frequent, or in which so many varieties of temperature occur.

The harvest is frequently three weeks or a month earlier in the northern than in the southern districts. Towards the coast the snow soon disappears, but in the uplands it lies long on the ground, and the highest parts of the Lammermuir are occasionally covered with snow during a fourth part of the year. In general the climate is considered salubrious and remarkably free from endemic disease and contagious fever. The vegetation is comparatively early, but subject to injury from the easterly winds during the months of April and May.

Fisheries.—Of late years the herring-fishery has not proved so productive as formerly, and the same circumstance has occurred lately on all the northern coasts of Scotland, the best explanation of which seems to be the uncertain habits of this fish. In August and September,

* Rees's 'Cyclopædia,' quoting from the 'Biographia Britannica,' ascribes the expense (20,000*l.*) to Hacket himself, but the exact sum he subscribed was 1683*l.* 12*s.* See Britton's 'British Cathedrals.'

when the shoals appear off the coast, the number of boats employed usually exceeds 300. The cod is pickled, and shipped to London; the haddock is principally smoked, and sent to Glasgow and Edinburgh. Lobsters are caught off Dunbar and are preserved in pits called 'hullies,' cut out of the solid rock within sea-water mark; they are chiefly sent to the London market. The earl of Haddington possesses the exclusive right of fishing along the coast from the mouth of the Peffer to Belhaven Bay.

Hydrography, Roads, &c.—The source of the Tyne is in Mid Lothian, a few miles west of Haddingtonshire, the borders of which it crosses near to Ormiston Hall. In its course, which is nearly due east, inclining towards the north, it passes the county-town of Haddington, dividing it from the suburb of Nungate; it thence flows through the remainder of the midland district and falls into the sea near Tynningham House, about three miles westward of Dunbar. Throughout its course it is an inconsiderable river, and owing to a bar at its entrance it is rendered difficult of access. The river abounds with large trout, eels, and small salmon. The other rivers, or 'waters,' as they are provincially termed, are the Coalstone, Biel, Whitewater, and Fastna, on the south of the Tyne, and the Peffer to the north, by means of which, and their tributaries, nearly the whole county is well watered. According to the parliamentary returns of 1836 the rents of the turnpike-roads of Haddingtonshire for the year ending Whitsunday, 1835, amounted to 5617*l.* 18*s.* 3*d.*; they are generally kept in good repair.

Manufactures.—Several attempts have been made to introduce manufactures into this county. About the beginning of the last century the first mill known in Scotland for the manufacture of pot-barley was erected in the parish of Salton, and about the same period the first manufactory known in Britain for weaving hollands was also established in this county. In 1792 a flax-mill was erected at West Barnes, and in 1815 a cotton manufactory was established at Belhaven. These, though carried on for a time with apparent advantage, have been discontinued, as have also the paper-mills and starch-works. At Preston Pans and at Tranent there were formerly some extensive salt-works, which, though not quite extinct, have declined considerably since the repeal of the salt duties. At present the principal article manufactured in the county is draining-tiles, the demand for which is annually increasing. There are however several large distilleries and a few other manufactures of minor extent and importance, employing but few hands and returning little profit.

Agriculture.—From Haddingtonshire the improved system of agriculture has been diffused over Scotland, and this county continues to hold a high rank in respect of agriculture and produce*. In 1811 the whole property of the county was divided into 183 estates, of which the valued rent of more than one-half was only 100*l.* Scots per annum. The inequality of this distribution, arising out of the system of strict entail so general throughout Scotland, has not, we believe, since undergone any material alteration. The smaller farms are on the most productive soils. Wheat is the principal grain cultivated, though large crops of beans and oats are likewise raised. The turnip crops were said to surpass those of any other part of the kingdom. They are generally cultivated in drills, and consumed on the ground by sheep. Barley is not much cultivated. The usual rotation of crops upon clay soils is—1st, oats; 2nd, beans, drilled and manured; 3rd, wheat; 4th, fallow or turnips; 5th, wheat or barley; 6th, grass. But upon the free loam or lighter soils the 'four-course shift' is frequently followed, viz. 1st, oats; 2nd, turnips; 3rd, wheat, sown in spring, or barley; 4th, grass. In some cases the continuance of the grass a second year is considered advantageous to the farmer. The stubble is ploughed early in winter, and great attention is paid to the thorough eradication of weeds, particularly of annual weeds from among the growing corn. The lease prohibits the farmer from taking two successive white crops, and binds him moreover always to keep a specified portion of land either in fallow or green crop, and a specified portion in seeds and wheat. Notwithstanding these precautions, the fertility of the soil is believed to have been much impaired by an excessive cultivation of corn, which the farmers are now endeavouring to correct by resorting more extensively to pastures, and for a longer period than formerly. The present farmers are intelligent and skilful. Since the increase of pasture-land the breeding of sheep and cattle has been extended, but breeding in the lowland and midland districts is carried on upon a very limited scale, the more usual practice being to purchase and fatten for the Edinburgh market. In the Lammermuir district however the breeding of live-stock is the chief business of the farmer. The short-horned or Teeswater breed of cattle was first introduced into East Lothian about 1825, and it is that to which most attention is now paid. The Leicester and Cheviot breeds of sheep are those principally reared, and a considerable number are now bred, and fed off at two years old. 'The sheep stock are bought at the spring and autumn markets. A few Leicester ewes for early lambs are kept, and to a greater extent Cheviot and black-faced ewes, which, with their lambs, are fattened upon grass for the Edinburgh market. Besides these, a large proportion of the land is pastured with cattle, and Cheviot and black-faced wedders. When turnips are let, the price per week is from 4*d.* to 6*d.* per sheep.' (*New Statistical Account of Scotland.*) The use of fallows was introduced by the earl of Haddington in 1708, and was extensively practised in this county long before it was resorted to in any other part of Scotland. At the present time the use of fallows in the lower districts has been in a great measure superseded by the extensive cultivation of turnips. The manure of the farmyard is that most generally resorted to throughout the county, but sea-weed is employed along the coast, and lime in the upper districts. Rape cake and pulverized bones are also used. Great attention is now paid to the more complete drainage of the soil; the most recent improvements in agricultural implements have been adopted, and there are few farms without threshing-mills, although the employment of the two-horse plough has only been introduced within the last half century. The farms average from 300 to 500 acres each, and are held on lease for terms varying from nineteen to twenty-one years. The rent of some soils in the neighbourhood of Dunbar is as high as 6*l.* per acre, but the average for arable land is about 42*s.*, and is payable either in money or else in grain, at the medium 'fiars' of the county. The construction of the farm-houses has greatly improved within the last half century, and their present appearance indicates the amelioration which has taken place in the circumstances of the farmer within that period.

'The farm servants of East Lothian enjoy the comforts of society in a greater degree than persons of the same rank of life in any other part of the country. They are for the most part allowed a cow's grass and potato land, and have an opportunity of keeping a pig, and in some instances poultry, which enables them to keep their families in a state of comfort superior to most of the labouring classes elsewhere, and they are in general quite contented with their situation and circumstances.' (*New Statistical Account of Scotland*, part viii., p. 23.)

Antiquities.—Circular mounds or encampments are occasionally met with in conspicuous situations. There are also numerous old castles, some of which are in a tolerable state of preservation. Of these it will be sufficient to mention the castles of Dunbar and Hailes, Tantallan, once the residence of the Douglasses, which stands close to the sea, the castles of Dirlton, Luffness, &c.

Geology.—The following account of the geology of Haddingtonshire is almost wholly taken from the papers by Prof. Jameson and Dr. Macknight, in the 'Memoirs of the Wernerian Society of Natural History.' No fixed primitive rocks have hitherto been discovered in this part of Scotland. The old red sandstone forms a considerable portion of the county and generally rests upon transition rocks, and is covered by the coal formation. It is of a brownish-red colour, though occasionally of a yellowish or greyish white. 'Its principal ingredient is quartz, which is in grains, and these are either joined together without a basis, or ground, or they are imbedded in a red-coloured clay. It alternates from very fine to very coarse granular, thus passing into the conglomerate.' (Prof. Jameson.) The strata vary from a few inches to several feet in thickness, and are generally inclined to the horizon. The dip seldom exceeds 45°, and the usual direction is from north-east to south-west. The Lammermuir range is composed principally of greywacke; the position of the strata is nearly vertical. The Garlton hills consist of a

* This spirit of improvement was introduced by Mr. Cockburn of Ormiston, who was a Lord of the Admiralty in the reign of George I. He resigned his public employments, and retired to his native county to introduce there the improved agriculture of England. By surpassing in his improvements the mode of culture of the south, he reflected back upon England the improvements originally derived from her.

sort of clinkstone, apparently contemporaneous with North Berwick Law and Trapraine, the two principal heights in the vicinity.

The harbour of Dunbar is situated in a red-coloured traprock, which forms a single bed of great thickness. To the south-east of the harbour the coast is low and sandy, consisting of old red conglomerated sandstone, trap-tufa, and greenstone rock. The lower strata of the sandstone are calcareous, containing the impressions of animals and vegetables. To the north-west of the harbour the coast is more elevated and rugged, consisting of lofty cliffs of red-coloured traptufa, which are succeeded by others of red and white sandstone. The tufa is much used in the construction of ovens. From Belhaven Bay to North Berwick the coast is low and sandy, with the exception of the small promontory of Whitberry Head and Ravensheugh Craig. Whitberry Head has been described by Dr. Macknight in the 'Memoirs of the Wernerian Society,' under the name of Ravensheugh. The approach to it on the land side is gradual, but towards the sea it presents a precipitous front from 40 to 50 feet in height. 'It is a trap formation apparently overlying, but in reality subordinate to the old red sandstone, and consists of basalt with crystals of hornblende, red and green traptuff impregnated with lime, beautiful clinkstone and clinkstone-porphyry, or porphyry slate.' (Dr. Macknight.) About a mile north-west of Whitberry is the elevated rock called Ravensheugh Craig, consisting principally of clinkstone and basalt, with crystals of hornblende. To the north of the Peffer the coast again becomes elevated, and near Tantallan castle the cliffs are particularly rugged, and rise to the height of 100 feet. About a mile to the south-east of the above town stands the beautiful hill called North Berwick Law. Its form is that of a cone, having its apex 500 feet above the sea-level. 'The lowest rock visible is a variety of the trap-tuff. Higher up is amygdaloid. The middle and upper parts of the hill are of a beautiful and very sonorous variety of clinkstone-porphyry; and the summit-rock clinkstone-porphyry, intermixed with crystals of augite, thus forming a transition into greenstone. The clinkstone is in some places columnar, and forms cliffs of considerable magnitude.' (Professor Jameson.) The western part of the county contains excellent coal, which belongs to the great coal-field of Scotland that lies to the south of the Forth and Clyde.

Chief Towns.—Haddington is the county town and a royal burgh of considerable antiquity. It is 16 miles east from Edinburgh. Its records are said to have been destroyed during the invasions of the English, by whom the town was several times burnt, so that the period at which it became a burgh of regality is not known. The oldest charter extant is that of James VI., dated 13th January, 1624. The town is the birth-place of John Knox, the Scotch reformer, who also received his education at the grammar-school of the burgh. It is agreeably situated at the foot of the Garlton hills, which shelter it on the north. On the east it is separated by the Tyne from the suburb of Nungate, with which it communicates by a stone bridge of four arches. The town is paved, and lighted with gas, and consists principally of two streets running east and west, intersected by a third at right angles. The church is a venerable structure in the Gothic style, surmounted by a square tower 90 feet high. The choir and transept are in a dilapidated state. There are some other public buildings on a large and elegant scale, and the suburbs are adorned by numerous villas with adjoining grounds and gardens. The management of the affairs of the burgh is vested in a council of 25 persons, who are elected pursuant to the provisions of the Burgh Reform Act. The magistrates consist of a provost, three baillies, a treasurer and dean of the guild. The average income of the burgh, arising from lands, fees, customs, &c., is about 1400*l.* The county courts are held here during the session by the sheriff, and there is also a small-debt court every alternate Thursday. The town carries on a considerable trade in wool, in tanning, and in preparing bones and rape-cake for manure. It is also one of the largest wheat-markets in Scotland. Besides breweries there are two extensive distilleries in the vicinity, but the working of the latter had been discontinued in 1835.

Haddington, in union with Jedburgh, Dunbar, Lauder, and North Berwick, returns one member to parliament. The county also returns one member. The population of the burgh and parish in 1831 was 5883. Besides the parochial school, which is supported by the landward heritors, there is an endowed grammar-school and a school for English reading, writing, arithmetic, and geography, with a department for mathematics. In 1823 a mechanic's institution was founded, and is now provided with a suitable apparatus, museum, and library. The town is also the head-quarters of the Itinerary Libraries, first established by Samuel Brown, Esq. in 1817. Besides branches of the Bank of Scotland and the British Linen Company, there is a savings' bank, established in 1815. Several benevolent and friendly societies have been established within the last few years. The poor are provided for by an annual assessment and by voluntary donations.

The seaport town of Dunbar, situated 28 miles east north from Edinburgh, is mentioned as early as the year 856, when it was burned by Kenneth, king of Scotland. It was again destroyed in 1548 by an English army, sent by Henry VIII. to chastise the Scots for refusing to sanction the alliance of their young queen with his son. The town was first erected into a free burgh by David II., and its privileges have since been confirmed and extended by several royal charters. Its annual revenue, arising from lands and imposts, is about 1300*l.*, and the management of its affairs is vested in a provost, 3 baillies, a treasurer, and 15 councillors. The harbour, though difficult of access, is safe and commodious, and will admit vessels of 300 tons burthen. At spring-tides there are 14 feet water, and at neap-tides 9 feet. The custom-house dues for the year ending January 5, 1835, amounted to 2942*l.* 15*s.* Dunbar was formerly noted for its malt; at the present time it is equally famed for its ale. Here once stood the castle to which Queen Mary fled in 1565, after the assassination of Rizzio. For a particular account of the ruins of this remarkable fortress the reader is referred to Sir Walter Scott's 'Provincial Antiquities.' The population of the burgh and parish in 1831 was 4735. Besides two parochial and three unendowed schools, there are a grammar-school and a mathematical school. The master of the grammar-school has a house and a salary of 40 guineas; the teacher of the mathematical school, a house and a salary of 20*l.* The only friendly society now existing is that called the 'Sailors' Society.' This has been long established, and its affairs so well conducted, that at the present time it possesses landed property. [BERWICK, NORTH.]

Population.—The county is divided into 25 parishes, the aggregate population of which in 1831 was 36,145, viz. 17,397 males and 18,748 females. In 1821 the population was 35,127, and in 1811 it was 31,164, thus showing an increase of nearly 13 per cent. in the 10 years ending with 1821, but less than 3 per cent. in the 10 years ending with 1831. The area comprises 174,080 acres.

Education.—The means of education in this, as in most other counties of Scotland, are very generally diffused among the labouring classes. Besides the private and unendowed schools, there are numerous parochial and Sunday schools. The latter are usually taught by the elders of the established church, 'each taking charge as far as is practicable of the young in his own allotted district of the parish.' (*New Statistical Account.*) In some parishes there is a regulation that no farm servant shall pay more than 40*s.* per annum, whatever number of children he may have attending the parochial school; in others, if the parents are too poor to pay for the education of their children, the school fees are paid for them. This is the custom in the parish of Ormiston, wherein it is said that no children are to be found between the ages of six and fifteen who can neither read nor write.

(Playfair's *Geographical Description of Scotland;* Sinclair's *General Account of Scotland;* Sinclair's *Husbandry of Scotland; New Statistical Account of Scotland;* MacCulloch's *Statistical Account of Great Britain; Memoirs of the Wernerian Society;* Somerville's *Survey of East Lothian; Parliamentary Papers,* &c.)

HADDOCK, a species of codfish. [MORRHUA.]

END OF VOLUME THE ELEVENTH.

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